

NTPC VIDYUT VYAPAR NIGAM LIMITED

(A wholly owned Subsidiary of NTPC Limited)



BIDDING DOCUMENTS

FOR

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO.: NVVN/C&M/RE-333/2024-25

(This Document is meant for the exclusive purpose of bidding against this Bid Document No./ Specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued.

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NTPC VIDYUT VYAPAR NIGAM LIMITED

(A wholly owned Subsidiary of NTPC Limited)

CONTRACT & MATERIALS, NEW DELHI

SECTION I

DETAILED INVITATION FOR

BIDS (IFB)FOR

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT

(50 MW)AT

**Hope Town, Sri Vijaya Puram,
Andaman & Nicobar Islands
(International Competitive Bidding)**

IFB No.: NVVN / C&M / RE-333/ 2024-25

1. NTPC VIDYUT VYAPAR NIGAM LIMITED (NVVN) invites online Bids from eligible bidders on single stage two envelope (i.e. envelope-I techno commercial Bid and envelope-II price Bid), for aforesaid Package, as per the Brief Scope of Work mentioned hereinafter.

2. BRIEF SCOPE OF WORK

The scope of the proposal for Engineering, Supply, Erection, Testing & Commissioning works for Andaman & Nicobar Gas Power Project (50 MW \pm 10%) shall be on the basis of a single point responsibility, completely covering the following activities and services in respect of all the equipment specified and covered under the specifications and read in conjunction with “Scope of Supply & Services”, Volume-III, Part-A, Section –VI of Technical Specification.

i) Basic Engineering of the plant including preparation of plant design manuals for the power project.

ii) Detailed design of all the equipment and system(s) including grouting of the equipment and fixing supports in wall, structure steel works included in bidder's scope for the Project.

iii) Providing engineering drawings, equipment sizing & performance data, instruction manuals, as built drawings, O&M manuals and other information for Employer's approval.

iv) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required.

- v) Complete manufacturing including shop testing/type testing.
- vi) Complete structural work related to all equipment erection as per scope of this package in Part A, Volume III, providing construction offices, field laboratory, construction equipment, construction power and construction water.
- vii) Packing and transportation from the manufacturer's work to the site including customs clearance/port clearance, port charges, if any.
- viii) Receipt, storage, preservation and conservation of equipment at the site.
- ix) Fabrication, pre-assembly, if any, erection, testing and putting into satisfactory operation all the equipment including successful completion of facilities.
- x) Reliability tests and owner acceptance including the tests for performance demonstration after successful completion of facilities.
- xi) Furnishing of spares on FOR (Freight on Road) site basis.
- xii) Reconciliation with customs authorities, in case of foreign bidders.
- xiii) Satisfactory conclusion of the Contract.
- xiv) Insurance and other requirements for the complete Power plant package in accordance with the provisions of general conditions of contract (Section-IV) of the bidding document.
- xv) One year supervision during operation and maintenance with deputation of 1 operation and 1 maintenance expert post successful completion of initial/trial operations & Performance guarantee tests including Demonstration tests (whichever occurs later).

The Power plant is expected to run for its life on RLNG as fuel for the project.

Detailed scope of work has been specified in the bidding documents.

3. NVVN intends to finance subject Package through External Commercial Borrowings / Domestic Commercial Borrowings / Own sources.
4. All bids must be accompanied by Bid Security for an amount of **INR 10,00,00,000 (Indian Rupees Ten Crores only) or USD 1,171,800 (One Million One Hundred Seventy-One Thousand Eight Hundred US Dollars)** in the form as stipulated in the Bidding Documents.

ANY BID NOT ACCOMPANIED BY AN ACCEPTABLE BID SECURITY IN A SEPARATE SEALED ENVELOPE SHALL BE REJECTED BY THE EMPLOYER AS BEING NON-RESPONSIVE. IN CASE, THE BID SECURITY IS SUBMITTED THROUGH ELECTRONIC FUND TRANSFER (EFT), BIDDER TO SUBMIT THE PROOF OF E-PAYMENT OF BID SECURITY EITHER IN SEPARATE SEALED ENVELOPE OR IN THE E-TENDERING PORTAL.

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5. Detailed Specification, Scope of Work and Terms & Conditions are given in the Bidding Documents, which are available for examination and Sale at our GePNIC e-procurement portal <https://eprocentpc.nic.in> as per the following schedule:

Issuance of IFB	As per GePNIC Portal
Document Sale Dates	As per GePNIC Portal
Last Date for receipt of queries for clarification from prospective Bidders	As per GePNIC Portal
Last date of Pre Bid Meeting	As per GePNIC Portal
Last date and time for submission of online Bids comprising of Techno commercial and Price Bid	As per GePNIC Portal
Bid Opening Date & Time for Techno- commercial Bid	As per GePNIC Portal
Bid Opening Date & Time for Price-Bid	Shall be intimated separately by NVVN
Cost of Bidding Document in INR	₹ 22,500/- (Rupees Twenty-Two Thousand Five Hundred only) / \$ 500 (US Dollar Five Hundred only)

6. QUALIFYING REQUIREMENTS FOR BIDDERS

In addition to the requirements stipulated under section Instructions to Bidder (ITB), the Bidder should also meet the qualifying requirements stipulated hereunder in clauses 6.1.0 or 6.2.0 or 6.3.0 as the case may be and the clause 6.4.0 along with the notes:

6.1.0 Route-1: Engine Manufacturer

The Bidder should be an Engine manufacturer who has designed, manufactured, supplied and commissioned/ supervised commissioning of at least one (01) Gas Engine for power generation, having minimum rating as that of the offered Gas Engine which should have logged a minimum of 4000 fired/operating hours since commissioning and should have been in successful operation, for a period of at least one (01) year, prior to the date of techno-commercial bid opening.

6.2.0 Route 2: Engineering Procurement & Construction

6.2.0(i) The bidder should have executed in last 10 years contracts involving engineering, supply, erection/supervision of erection, commissioning/supervision of commissioning, in the area of power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry with the total value of such contracts being INR 1000 million or more. At least one such contracts should have a contract value of INR 300 million or more. These projects should have been in successful operation for a period of not less than one (01) year prior to the date of techno-commercial bid opening.

6.2.0(ii) The Bidder shall associate/collaborate with an Engine Manufacturer meeting requirements of 6.1.0 above, who shall also be the supplier of the Gas Engines for this contract. In such an event, the Bidder along with its techno-commercial bid, shall furnish a letter of undertaking from above associate/collaborator, as per format enclosed in the bidding documents, for successful performance of Gas engines, failing which the bidder shall be disqualified, and its bid shall be rejected.

6.3.0 Route-3: Indian Subsidiary Company of Qualified Engine Manufacturer

The Bidder should be an Indian subsidiary of a firm meeting the requirements of clause 6.1.0. The firm meeting the requirement of clause 6.1.0 shall be the supplier of Gas Engines for this contract.

Further the bidder should have executed/be executing in last 10 years contracts involving engineering, supply, erection/supervision of erection, commissioning/supervision of commissioning, in the area of power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry with the total value of such contracts being INR 1000 million or more. At least one of such contracts should have a contract value of INR 300 million or more.

Note:

1. For qualification under clause 6.1.0 or 6.2.0 or 6.3.0, a firm can meet the requirements stipulated under clause 6.1.0 or 6.2.0 or 6.3.0 above either singularly or collectively along with its Subsidiaries (held directly or indirectly)/ Holding Company. In case of the firm meeting the requirements of clause 6.1.0 or 6.2.0 or 6.3.0 collectively along with its subsidiaries)/ Holding Company, the Bidder along with its techno-commercial bid shall furnish a letter jointly signed by the bidder and the Holding Company/ all its Subsidiary(ies) extending support to the bidder for complying the requirements of clause 6.1.0 or 6.2.0 or 6.3.0 for successful performance of the Contract, as per the format enclosed in the bidding documents, failing which the Bidder shall be disqualified and its bid shall be rejected.
- 2a. The word “executed” in Clause 6.2.0(i) & Clause 6.3.0(i) means the Bidder should have:
 - (i) in case of Project(s), commissioned the project(s) specified in the Clause 2.0(i)/ Clause 3.0(i) even if the contract has been started earlier and / or is not completed / closed.
 - (ii) in case of Contract(s), completed the scope of work under the contract(s) specified in the Clause 2.0(i)/ Clause 3.0(i) even if the contract has been started earlier and / or is not closed..
- 2b. The word “be executing” in Clause 6.3.0(i) means the Bidder should have received the contract prior to the date of techno-commercial bid opening.

6.4.0.0 Financial Criteria:

6.4.1.0 Financial Criteria for the Bidder

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6.4.1.1 The average annual turnover of the Bidder, in the preceding three (3) financial years as on the date of techno-commercial bid opening, should not be less than **INR 1977 Million (Indian Rupees One Thousand Nine Hundred Seventy Seven Million only)** or in equivalent foreign currency.

In case a Bidder does not satisfy the average annual turnover criteria, stipulated above on its own, its Holding Company would be required to meet the stipulated turnover requirements as above, provided that the Net Worth of such Holding Company as on the last day of the preceding financial year is at least equal to or more than the paid-up share capital of the Holding Company. In such an event, the Bidder would be required to furnish along with its Techno-Commercial bid, a Letter of Undertaking from the Holding Company, supported by the Holding Company's Board Resolution, as per the format enclosed in the bid documents, pledging unconditional and irrevocable financial support for the execution of the Contract by the Bidder in case of award.

6.4.1.2 Net worth should not be less than 100% (hundred percent) of the bidder's paid up share capital as on the last day of the preceding financial year. In case the Bidder does not meet the Net worth criteria on its own, it can meet the requirement of Net worth based on the strength of its Subsidiary(ies) and/or Holding Company and/or Subsidiaries of its Holding companies wherever applicable. In such a case, however the Net worth of the Bidder and its Subsidiary(ies) and/or Holding Company and/or Subsidiary(ies) of the Holding Company, in combined manner should not be less than 100% (hundred percent) of their total paid up share capital. However individually, their Net worth should not be less than 75% (seventy five percent) of their respective paid up share capitals.

Net worth in combined manner shall be calculated as follows:

$$\text{Net worth (combined)} = (X1+X2+X3) / (Y1+Y2+Y3) \times 100$$

Where X1, X2, X3 are individual Net worth which should not be less than 75% of the respective paid up share capitals and Y1, Y2, Y3 are individual paid up share capitals.

6.4.1.3 In case the Bidder is not able to furnish its audited financial statements on standalone entity basis, the unaudited unconsolidated financial statements of the Bidder can be considered acceptable provided the Bidder furnishes the following further documents on substantiation of its qualification:

i. Copies of the unaudited unconsolidated financial statements of the Bidder along with copies of the audited consolidated financial statements of its Holding Company.

ii. A Certificate from the CEO/CFO of the Holding Company, as per the format enclosed in the bidding documents, stating that the unaudited unconsolidated financial statements form part of the Consolidated Annual Report of the Company.

6.4.1.4 In cases where audited results for the last financial year as on the date of Techno Commercial bid opening are not available, the financial results certified by a practicing Chartered Accountant shall be considered acceptable.

In case, the Certificate from a practicing Chartered Accountant certifying financial results is not available, the audited results of three consecutive financial years preceding the last financial year shall be considered for evaluating the financial parameters. Further, a Certificate would be required from the respective CEO/CFO as per the format enclosed in the bidding documents stating that ***“the financial results of the Company are under audit as on the date of Techno-commercial bid opening and the financial results certified by a practicing Chartered Accountant are not available”***.

6.4.2.0 Financial Criteria for the Collaborator(s) / Associate(s)

6.4.2.1 The average annual turnover of the Collaborator(s) / Associate(s), in the preceding three (3) financial years as on the date of techno-commercial bid opening, should not be less than **INR 989 Million (Indian Rupees Nine Hundred Eighty Nine Million only)** or in equivalent foreign currency.

In case the Collaborator/Associate does not satisfy the average annual turnover criteria above on its own, its Holding Company would be required to meet the stipulated turnover requirements at Cl. 6.4.2.1 above, provided that the net worth of such Holding Company, as on the last day of the preceding financial year is at least equal to or more than the paid-up share capital of the Holding Company. In such an event, the Collaborator/Associate would be required to furnish along with bidder's Techno-Commercial bid, a Letter of Undertaking from the Holding Company, supported by Board Resolution of the Holding Company, as per the format enclosed with the bidding documents, pledging unconditional and irrevocable financial support to the Collaborator/Associate to honour the terms and conditions of the Undertaking in case of award of the Contract to the Bidder with whom Collaborator/Associate is associated.

6.4.2.2 The Net Worth of each Collaborator/Associate, as on the last day of the preceding financial year as on the date of Techno-commercial bid opening should not be less than 100% (hundred percent) of its paid-up share capital. In case the Collaborator/Associate does not meet the Net worth criteria on its own, it can meet the requirement of Net worth based on the strength of its Subsidiary(ies) and/or Holding Company and/or Subsidiaries of its Holding companies wherever applicable. In such a case, however the Net worth of the Collaborator/Associate and its Subsidiary(ies) and/or Holding Company and/or Subsidiary(ies) of the Holding Company, in combined manner should not be less than 100% (hundred percent) of their total paid up share capital. However individually, their Net worth should not be less than 75% (seventy five percent) of their respective paid up share capitals.

Net worth in combined manner shall be calculated as follows:

$$\text{Net worth (combined)} = (X1+X2+X3) / (Y1+Y2+Y3) \times 100$$

Where X1, X2, X3 are individual Net worth which should not be less than 75% of the respective paid up share capitals and Y1, Y2, Y3 are individual paid up share capitals.

6.4.2.3 In case the Collaborator(s) / Associate(s) is not able to furnish its audited financial statements on standalone entity basis, the unaudited unconsolidated financial

statements of the Collaborator(s) / Associate(s) can be considered acceptable provided the Collaborator(s) / Associate(s) furnishes the following further documents on substantiation of its qualification:

(i) Copies of the unaudited unconsolidated financial statements of the Collaborator(s) / Associate(s) along with copies of the audited consolidated financial statements of the Holding Company of Collaborator(s) / Associate(s).

(ii) A Certificate from the CEO/CFO of the Holding Company, as per the format enclosed with the bidding documents, stating that the unaudited unconsolidated financial statements form part of the consolidated financial statements of the Holding Company of Collaborator/Associate.

6.4.2.4 In cases where audited results for the last financial year as on the date of Techno Commercial bid opening are not available, the financial results certified by a practicing Chartered Accountant shall be considered acceptable.

In case, the Certificate from a practicing Chartered Accountant certifying financial results is not available, the audited results of three consecutive financial years preceding the last financial year shall be considered for evaluating the financial parameters. Further, a Certificate would be required from the respective CEO/CFO as per the format enclosed in the bidding documents stating that ***“the financial results of the Company are under audit as on the date of Techno-commercial bid opening and the financial results certified by a practicing Chartered Accountant are not available”***.

6.4.3.0 Financial Criteria for the Holding Company (in case of Bidder participating through clause 6.3.0)

The Holding company should meet the financial criteria as given in clause 6.4.1.0 for Bidder.

NOTES:

- (i) Net worth means the sum total of the paid-up share capital and free reserves. Free reserve means all reserves credited out of the profits and share premium account but does not include reserves credited out of the revaluation of the assets, write back of depreciation provision and amalgamation. Further any debit balance of Profit and Loss account and miscellaneous expenses to the extent not adjusted or written off, if any, shall be reduced from reserves and surplus.
- (ii) Other income shall not be considered for arriving at annual turnover.
- (iii) "Holding Company" and "Subsidiary Company" shall have the meaning ascribed to them as per Companies Act of India.
- (iv) For annual Turnover indicated in foreign currency, the exchange rate as on seven (7) days prior to the date of Techno-Commercial bid opening shall be used.
- (v) For Turnover and Net worth only standalone Financial Statement of Bidder/Associate/Collaborator/ Holding/subsidiary(s) shall be considered.

7. NVVN reserves the right to reject any or all Bids or cancel / withdraw the Invitation for Bids without assigning any reason whatsoever and in such case no Bidder / intending Bidder shall have any claim arising out of such action.
8. A complete set of Bidding Documents may be downloaded from <https://eprocurementpc.nic.in> by any interested Bidder. Tender Fee (₹ 22,500 or \$500), in the form of A/C PAYEE DEMAND DRAFT / BANKERS CHEQUE / PAY ORDER in favor of “NTPC VIDYUT VYAPAR NIGAM LIMITED”, payable at NEW DELHI, as mentioned above is required to be submitted in a separately sealed envelope at the address mentioned in the bidding document, before the stipulated date & time of submission of bid. For any assistance, please email to nvvncontracts@ntpc.co.in or contact Sr. Manager-C&M, NTPC VIDYUT VYAPAR NIGAM LIMITED, 5th Floor, Engineering Office Complex, A-8A, Sector 24, Noida – 201301.

It is required by the agency to register and follow the guidelines / FAQ provided in the e- portal <https://eprocurementpc.nic.in> for participating in the tender *BID is to be submitted online on that portal*. Any amendment(s) / corrigendum / clarifications with respect to this Bid shall be uploaded on <https://eprocurementpc.nic.in> only. The Bidder should regularly follow up for any Amendment / Corrigendum / Clarification on the above website.

Note: No hard copy of Bidding Documents shall be issued.

9. Any ‘Bidder from a country which shares a land border with India’, as specified in the Bidding Documents, will be eligible to bid in this tender only if bidder is registered with the Competent Authority as mentioned in the Bidding Documents.

Further, any bidder (including bidder from India) having specified Transfer of Technology (ToT) arrangement with an entity from a country which shares a land border with India, will be eligible to bid only if the bidder is registered with the same competent authority.

However, the said requirement of registration will not apply to bidders from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects.

10. Transfer of Bidding Documents purchased by one intending Bidder to another is not permissible.
11. Downloading/Issuance of Bidding Documents and /or submission of Bid shall not construe that such Bidder is considered to be qualified.

12. Address for communication:

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For the detailed IFB and bidding documents please visit e-portal <https://eprocurrentpc.nic.in> or may contact:

General Manager (C&M) / Manager (C&M),
NTPC VIDYUT VYAPAR NIGAM LIMITED,
Fifth Floor, Engineering Office Complex,
A-8A, Sector-24, NOIDA,
Distt. Gautam Budh Nagar, (UP), INDIA
Pin – 201301
Tel No. (+91)-120-4947239
E-mail: nvvncontracts@ntpc.co.in

Corporate Identification Number: U40108DL2002GOI117584, Website: www.nvvn.co.in

13. Registered Office

NTPC VIDYUT VYAPAR NIGAM LIMITED
NTPC Bhawan, Core-7, SCOPE
Complex,7, Institutional Area, Lodhi
Road, New Delhi – 110003

Corporate Identification Number: U40108DL2002GOI117584 Website: www.nvvn.co.in

14. Other Instructions

- i. Please use “Online Bidder Enrollment” link provided on portal <https://eprocurrentpc.nic.in> (GePNIC) to register.
- ii. Go through Help, FAQ etc as provided on above portal.
- iii. Class III Digital Signature (DSC) is required for submission of BID on above portal.
- iv. Important Note: It is strongly recommended that all authorized users of Supplier organizations should thoroughly peruse the information provided under the relevant links and take appropriate action. This will prevent hiccups and minimize teething problems during the use of GePNIC.

GePNIC Helpdesk Telephone: 24x 7 Customer Support: +91-120-4001 002 / +91-120-4200 462 / +91-120-4001 005 / +91-120-6277 787

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SECTION – II

INSTRUCTION TO BIDDERS

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14. Format and Signing of Bid

D. Submission of Bids

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INSTRUCTIONS TO BIDDERS (ITB)

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41. "Restrictions on procurement from a Bidder of a country which shares a land border with India"

INSTRUCTIONS TO BIDDERS (ITB)

A. Introduction

1. Source of Funds

- 1.1** NTPC Vidyut Vyapar Nigam Limited (hereinafter called 'NVVN' or 'Employer'), intends to finance the package named in the Bid Data Sheet (BDS), through external commercial borrowings and / or own resources.
- 1.2** NVVN intends to make financing arrangements for the subject package by means of Buyers Credit from International Banks through the Export Credit Agencies of the Country concerned to the extent the goods and services covered in the package are eligible for ECA Financing. For the above purpose, the Export Credit Agencies require certain procedural formalities to be completed by the equipment supplier of their country. The bidder shall, in case of award of contract, facilitate completion of such formalities as may be required by the respective Export Credit Agency to enable employer to avail Buyers Credit for funding eligible goods and services covered in the package. The aforesaid option of funding is also intended to be availed by the employer for supply of goods and services by the sub-vendors/sub-contractors of the Bidder. The Bidder shall make similar compliance in respect of its sub-vendors/subcontractors to the extent the goods are eligible for ECA Financing.

2. Eligible Plant, Equipment and Services

- 2.1** For the purposes of these bidding documents, the word "facilities" means the plant and equipment to be supplied and installed, together with the services to be carried out by the contractor under the contract. The words "plant and equipment", "installation services" etc., shall be construed in accordance with the respective definitions given to them in the General Conditions of Contract.
- 2.2** Bidding is open to bidders from within/outside the Employer's country, subject to fulfilment of conditions specified in ITB Clause "Restrictions on procurement from a Bidder of a country which shares a land border with India".
- 2.3** For purposes of this clause, "origin" means the place where the plant and equipment or component parts thereof are mined, grown, or produced. Plant and equipment are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.
- 2.4** The origin of the plant, equipment, and services is distinct from the nationality of the Bidder.

3. Cost of Bidding

- 3.1.** The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

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INSTRUCTIONS TO BIDDERS (ITB)

B. The Bidding Documents

4. Content of Bidding Documents

4.1. The facilities required, bidding procedures, contract terms and technical requirements are prescribed in the bidding documents. The bidding documents include the following sections:

Section I – Invitation for Bids (IFB)
Section II – Instructions to Bidders (ITB)
Section III – Bid Data Sheet (BDS)
Section IV – General Conditions of Contract (GCC)
Section V – Special Conditions of Contract (SCC)
Section VI – Technical Specifications (TS)
Section VII – Forms and Procedures (FP)

Section-VII (Book 1 of 3)

1a. Envelope-I (Techno-Commercial) Bid
(Bid Form along with Attachments)

Section-VII (Book 2 of 3)

1b. **Envelope-II (Price Bid)**
(Bid Form along with attachments and Price Schedules)

Section-VII (Book 3 of 3)

Standard Forms & Procedures

4.2. The Bidder is expected to examine all instructions, forms, terms, conditions, specifications, and other information in the bidding documents. Failure to furnish all information required as per the bidding documents or submission of a bid not substantially responsive to the bidding documents in every respect will be at the Bidder's risk and may result in rejection of its bid.

4.3. Mode of Tendering

The Bid is invited under e-tendering process. The bidding documents shall be published on the Government e-procurement portal of NIC (GePNIC) at address <https://eprocurementpc.nic.in/> (e-Tender Portal). The bidders can enroll themselves on the portal using the "Online Bidder Enrollment" tab. The use of Digital Signature Certificate (DSC) key is mandatory for e-tendering activities. Accordingly, bidders should have Digital Signature Certificate (DSC) key of Class 3 to participate in e-tendering. Bidders, if required, can obtain digital signature certificate (DSC) Key of Class 3 from agencies authorized by Govt. of India. The said portal also has the user manuals with detailed guidelines on enrollment and participation in the bidding process.

INSTRUCTIONS TO BIDDERS (ITB)

5. Clarification on Bidding Documents

5.1 A prospective Bidder requiring any clarification to the bidding documents may notify the Employer through 'Seek Clarifications' tab under e-Tender portal or through e-mail at the address indicated in Bid Data Sheet (BDS). The Employer will respond to any request for clarification or modification of the bidding documents that it receives no later than the last date of receipt of queries as specified in Invitation for Bids (IFB). The Employer will post the Clarifications at e-Tender Portal and Bidders can view these clarifications once they are posted at the portal. Bidders are also advised to regularly check at e-Tender Portal regarding posting of clarification, if any.

Further, no queries from Bidders shall be entertained after last date of receipt of Queries as specified in IFB. Accordingly, any query (ies) received from Bidders after the cut-off date shall not be considered and bidders to submit the bid based on the bidding documents (and amendments/ Errata/ Clarifications etc. thereof) issued.

5.2 The Bidder is mandatorily required to visit after NIT and examine the site where the facilities are to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for supply and installation of the facilities. The costs of visiting the site shall be borne by the bidder fully.

The Bidder shall submit the Site Visit Certificate as per Appendix-C to Attachment-3A-1, Book 1 of 3, Sec-VII of Bidding document, duly signed by bidder along with their Envelope-I (Techno-Commercial) Bid. Failing which the bid shall be liable for rejection.

5.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such inspection, but only upon the express condition that the Bidder, its personnel and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.

6. Amendment to Bidding Documents

6.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at its own initiative, or in response to a clarification requested by a prospective Bidder, amend the bidding documents.

6.2 The amendments will be posted at e-Tender portal for viewing by the Bidder. The amendments will be binding on Bidders and it will be assumed that the information contained therein will have been taken into account by the Bidder in its bid. Bidders are also advised to regularly check e-Tender portal regarding posting of Amendment, if any.

6.3 In order to afford prospective Bidders reasonable time in which to take the amendment into account in preparing their bid, the Employer may, at its

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discretion, extend the deadline for the submission of bids.

C. Preparation of Bids

7. Language of Bid

7.1 The bid prepared by the Bidder and all correspondence and documents related to the bid exchanged between the Bidder and the Employer shall be written in English language, provided that any printed literature furnished by the Bidder may be written in another language, as long as such literature is accompanied by a translation of its pertinent passages in English language in which case, for purposes of interpretation of the bid, the translation shall govern.

The English Translation of the documents shall be carried out by professional translators and the translator shall certify that he is proficient in both languages in order to translate the document and that the translation is complete and accurate. Further, translation shall be authenticated by the Indian Consulate located in the Country where the documents have been issued or the Embassy of that Country in India.

8. Documents Comprising the Bid

Single Stage Two Envelope Bidding procedure shall be followed as under:

Envelope-I: Techno-Commercial Bid

Envelope-II: Price Bid

The bidder has to submit Techno-Commercial Bid (Envelope-I) and Price Bid (Envelope-II) through e-Tender portal (electronic mode) only. In addition, the documents mentioned in clause no. 8.1.1 have also to be submitted in Original in physical mode before the last date & time of submission of bid. To submit their bid through electronic mode, bidder has to use their digital signature certificate keys. The bidders are requested to download the entire bidding documents from e-Tender portal, within the date and time as specified in the Invitation for Bids (IFB), after online registration in the above website

8.1 Envelope-I: Techno-Commercial Bid

The Techno-Commercial Bid comprises of following two categories of documents:

8.1.1 Documents to be submitted in physical form (offline) in separate sealed envelope(s) duly marked in accordance with ITB clause 15:

a) Attachment 1: Bid Security

Bid security shall be furnished in accordance with ITB Clause 12.0.

b) Attachment 1A: Tender Fee

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The tender fee shall be submitted Online prior to the last date and time for submission of Bid through NEFT/RTGS transfer in the account of NTPC Vidyut Vyapar Nigam Limited as per details given below:

- (i) Bank Name: ICICI Bank Limited
- (ii) Branch: CONNAUGHT PLACE BRANCH
- (iii) Bank Address: 9A, PHELPS BUILDING, CONNAUGHT PLACE, NEW DELHI-110001
- (iv) IFSC Code: ICIC0000007
- (iv) Account No.: 000705008910

While carrying out online transfer, Bidders shall ensure to enter “Tender Fee - Tender No.-Vendor Name” in the Text / Remarks / Reason field. Bidder shall intimate the details of same through email to concerned C&M executive and also upload the details in the Fee folder in GepNIC in the following format:

Declaration for Tender Fee Deposit

Tender No.:

Vendor Name:

UTR Reference:

Amount:

Date of Transfer:

Transferor Bank:

(Signature of Vendor with Seal)

c) Attachment 2: Power of Attorney

A power of attorney, duly notarized by a Notary Public, indicating that the person signing the bid has the authority to sign the bid and that the bid is binding upon the Bidder during the full period of its validity in accordance with ITB Clause 13.

Power of attorney(s), duly notarized by Notary Public, indicating that the person(s) signing the documents on behalf of Associate(s)/ collaborator(s)/ executants(s) of JV Agreement (if permissible in Section-III, Bid Data Sheet) have the authority to sign the same and the said documents are binding upon them during the full period of their validity.

(The Authority of the person issuing the Power of Attorney shall also be submitted).

Further, Bidder to note that bid can be submitted/digitally signed by only one person. The Power of Attorney must be in the name of the person digitally signing the bids.

d) ATTACHMENT 3I- Letter of Undertaking from Gas Engine manufacturer as per clause 6.2.0(ii) of IFB, if applicable

8.1.2 Documents to be submitted online through e-tender mode:

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The Bid Form as per Section-VII, Part 1 of 3, duly completed together with the following Attachments shall be uploaded on the e-tender portal in Pre-Qual/Technical Cover/Envelope.

a) Attachment 3: Bidder's Qualifications

In the absence of pre-qualification, documentary evidence establishing that the Bidder is qualified to perform the contract, if its bid is accepted, shall be furnished in Attachment-3 to bid.

The documentary evidence of the Bidder's qualifications to perform the contract, if its bid is accepted, shall establish to the Employer's satisfaction that the Bidder has the financial, technical, production, procurement, shipping, installation and other capacities and capabilities necessary to perform the contract and meets the experience and other criteria outlined below:

The Bidder shall provide satisfactory evidence that he and / or, where applicable, his collaborator / associate:

- (i) is a manufacturer/supplier, from an eligible source country, who regularly manufactures equipment of the type specified and/or undertakes the type of work specified and has adequate technical knowledge and relevant experience.
- (ii) does not anticipate a change in ownership during the proposed period of execution of work (If such a change is anticipated, the scope and effect thereof shall be defined).
- (iii) has adequate financial stability and status to meet the financial obligations pursuant to the works covered in the Bidding Documents. (The Bidders should submit their profit & loss account and balance sheet for the preceding three (3) financial years prior to the date of submission of bids).
- (iv) has adequate design, manufacturing and/or fabrication capability and capacity to perform the work properly and expeditiously within the time period specified. The evidence shall specifically cover, with written details, the installed manufacturing and/or fabrication capacities and present commitments (excluding those anticipated under this Specification) of the Bidder. If the present commitments are such that the installed capacity results in an inadequacy of manufacturing and/or fabrication capacities to meet the requirements appropriate to the works covered in his bid, then the details of alternative arrangements to be organized by the Bidder and/or his Collaborator/ Promoters to Joint Venture (JV) Company/Promoters to Subsidiary Company for this purpose and which shall meet the Employer's approval, shall be furnished.
- (v) has an adequate Project management organization covering the areas related to engineering of equipment/systems, interface engineering, procurement of equipment and the necessary field & management services required for successful construction,

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erection, testing and commissioning the equipment/system as required by the Bidding Documents.

- (vi) has established quality assurance systems and organisation designed to achieve high levels of equipment/system reliability, both during his manufacturing and/or fabrication and field installation activities.
- (vii) a company formed by the merger of two or more companies or divisions of such companies engaged in supply and installation of subject Package/systems can also participate provided the constituent companies or divisions before merger individually or jointly meet the stipulated qualification requirements fully.

In addition to the requirements stipulated above, the Bidder should also meet the qualifying requirements stipulated in Clause No. 6.0 of Invitation for Bid.

Bidder shall submit a 'Declaration' in the format enclosed as Attachment-3A15 stating that the Bidder has carried out a comprehensive assessment of the 'Capacity and Capability' of their Associate/ Collaborator and their Associate/Collaborator have sufficient Capacity & Capability to execute the Work as per Provisions of the Bidding Documents.

Notwithstanding anything stated above, the Employer reserves the right to undertake a physical assessment of the capacity and capabilities including financial capacity and capability of the Bidder / his Collaborator(s) / Associate(s) / Subsidiary(ies) / Group Company(ies) to perform the Contract, should the circumstances warrant such assessment in the overall interest of the Employer.

The physical assessment by the Employer shall include but not be limited to the assessment of the office/facilities/banker's/reference works/ similar project being executed by Bidder. A negative determination of such assessment of capacity and capabilities may result in the rejection of the Bid.

The above right to undertake the physical assessment shall be applicable for the qualifying requirements stipulated in both Section- ITB and in Section- BDS.

In case Bidder is permitted in the Bid Data Sheet to offer to supply and/or install plant and equipment under the contract that the Bidder did not manufacture or otherwise produce and/or install, the Bidder shall (i) have the financial and other capabilities necessary to perform the contract; (ii) have been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and/or install that item in the Employer's country; (iii) be responsible for ensuring that the manufacturer or producer of the related item meets the minimum criteria listed for that item.

(b) **Attachment 4: Eligibility and Conformity of the Facilities:**

Documentary evidence established in accordance with ITB Clause 2 that the facilities offered by the Bidder in its bid are eligible and conform to the bidding documents.

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The documentary evidence of the eligibility of the facilities shall consist of a statement on the country of origin of the plant and equipment offered, which shall be confirmed by a certificate of origin issued at the time of shipment.

The documentary evidence of the conformity of the facilities to the bidding documents may be in the form of literature, drawings and data, and shall include:

- (i) a detailed description of the essential technical and performance characteristics of the facilities;
- (ii) a list giving full particulars, including available sources, of all spare parts, special tools, etc., necessary for the proper and continuing functioning of the facilities following completion of facilities in accordance with provisions of contract; and
- (iii) a commentary on the Employer's Technical Specifications and adequate evidence demonstrating the substantial responsiveness of the facilities to those specifications. Bidder shall note that standards for workmanship, materials and equipment designated by Employer in the bidding documents are intended to be descriptive (establishing standards of quality and performance) only and not restrictive. The bidder may substitute alternative standards, brand names and/or catalogue numbers in its bid, provided that it demonstrates to Employer's satisfaction that the substitutions are substantially equivalent or superior to the standards designated in the Technical Specifications.

Attachment 4A: Special Tools and Tackles

The bidder shall provide the details regarding Special Maintenance Tools and Tackles. The cost of these Tools and Tackles shall be included in the lumpsum Bid Price quoted in Envelope-II(Price) Bid

(c) Attachment 5: Subcontractors Proposed by the Bidder

The Bidder shall include in its bid details of all major items of supply or services that it proposes to purchase or sublet and shall give details of the name and nationality of the proposed Subcontractor, including vendor, for each of those items. Bidders are free to list more than one Subcontractor/Vendor against each item of the facilities. Quoted rates and prices will be deemed to apply to whichever Subcontractor/Vendor is appointed, and no adjustment of the rates and prices will be permitted.

The Bidder shall be responsible for ensuring that any plant, equipment or services to be provided by the Sub-Contractor/Vendor complies with the requirements of ITB sub- clause 8.1.2 (a).

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Bidder may refer Annexure-VIII of GTR (Part-C), Section-VI (Technical Specifications) of bidding documents, while filling the details in respect of Sub-Contractors/ Sub-Vendors/ Sub-Suppliers.

The Employer reserves the right to delete any proposed Subcontractor/Vendor from the list prior to award of contract. After discussion between the Employer and the Contractor, Appendix 5 to Contract Agreement shall be completed, listing the approved Subcontractor(s) / Vendor(s) for each item.

(d) Attachment 6: DELETED

(e) Attachment 7: Details of Local Agent

If a foreign bidder has engaged an Indian agent, it will be required to give the following details in its bid as per the format enclosed in the Bidding Documents.

- (a) The name and address of the local agent;
- (b) What Service the agent renders.

(f) Attachment 8: Declaration on Demonstration Parameter

The declaration on demonstration parameters as per the Employer's format.

(g) Attachment 9: Erection Tools and Plant and Safety Equipments & Safety Personal Protective Equipments

List of Erection Tools and Plant and Safety Equipments & Safety Personal Protective Equipments which the bidder proposes to bring to site in case the contract is awarded to him.

(h) Attachment 10: Technical Data Sheet

The bidder shall essentially fill the chapter Essential Data, identified in Part-A, Technical Specification, Section-VI.

(i) Attachment 12: Quality Assurance Programme

Details regarding the overall quality management & procedures which the bidder proposes to follow during various phases of execution of the contract.

(j) Attachment 13: Additional Information

Additional Information including alternative offer (without price), which the bidder wishes to provide in his bid

(k) Attachment 14: Detailed work schedule (L2 Schedule)

A detailed work schedule (L2 Schedule) for the Project for which Bidder has submitted its Envelope-I (Techno-commercial) bid, in line with major

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project milestones specified in Sec-III (BDS) and as per requirements of ITB Clause 36.

(l) **Attachment 15:** EFT Form

(m) **Attachment 16: Integrity Pact**

The "Integrity Pact" shall be furnished duly signed in accordance with the provision of Integrity Pact specified in ITB Clause 41.0.

(n) **Attachment 17:** Declaration on Local Content

(o) **Attachment 18: Information regarding Safety Management**

(p) **Attachment 19: Check list**

8.1.3 General Technical Evaluation (GTE) Conditions:

Bidders shall be required to accept the following mandatory General Technical Evaluation (GTE) condition of the Tender at e-Tender Portal prior to the submission of Bid:

"Do you certify full compliance to all provisions of Bidding Document?"

By accepting above GTE, Bidder shall certify their compliance to all provisions of Bidding Documents including but not limited to the following important provisions:

- (a) Full compliance on Qualifying Requirements.
- (b) Fraud Prevention Policy of NTPC.
- (c) Policy for Debarment from Business Dealings of NTPC.
- (d) ITB Clause "Restrictions on procurement from a Bidder of a country which shares a land border with India"
- (e) All provisions of the Integrity Pact (if applicable)
- (f) Anti-Bribery and Anti-Corruption (ABAC) Policy of NTPC
- (g) ITB Clause "Conflict of Interest"

Acceptance of above GTE shall be considered as Bidder's confirmation that any deviation to any provision of the Bidding Documents found anywhere in their Bid Proposal, implicit or explicit, shall stand unconditionally withdrawn, without any cost implication whatsoever to the Employer, failing which the bid shall be rejected and bid security shall be forfeited.

Note: Techno-Commercial Bid should not contain any price content entry. In case, the Techno-Commercial Bid is found to contain any price content, such bid shall be liable for rejection.

8.2 Envelope-II: Price Bid

The Price Bids submitted by the Bidder shall comprise of the following:

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- 8.2.1 The Bid Form (Price Bid) as per Section-VII, part 2 of 3, duly completed together with the following attachments and Bill of Quantity (BOQ)/Price Schedules, shall be uploaded at e-Tender portal, in the Finance Cover/Envelope:

(Bidders may note that Attachments to Price Envelope together with BOQ/Price Schedules should NOT be uploaded in Pre-Qual/Technical Cover/Envelope at the e-Tender Portal.)

(a) **Attachment 1(P): Declaration regarding Import Content in Ex-works price**

Bidder may note that CIF value of import content in the Ex-works (India) price quoted in Schedule-2 of the bid, if any, shall be necessarily declared by the bidders in **Attachment-1P**. Bidder may further note that the relevant certificate for claiming the concessional custom duty benefits, if any shall be issued on the aforesaid declaration basis only. In case no such import content is envisaged in the bid or the CIF value of import content to be declared is zero, the bidder shall indicate "NIL" against the CIF value of import content.

In cases where no value is indicated by the bidder against the CIF value of import content in **Attachment-1P** or statement/ any declaration like 'later', 'to be furnished later', 'NA' etc. are indicated by the bidder, in such cases the CIF value of import content in the bid shall be considered as "NIL" for the purpose of issuance of relevant certificate for claiming the concessional custom duty benefits, if any. No further claim in this regard shall be entertained by the Employer.

(b) **Attachment 1A(P): CIF Value of Construction Equipment to be imported by the Bidder/Assignee**

Details of Construction Equipment to be imported by the Manufacturer or the bidder/ Assignee, as per the Employer's format.

(c) **Attachment 2(P): Details of Equipment and Mandatory Spares to be imported from Associate/Collaborator**

Details of Equipment (including type test) and Mandatory Spares to be imported from Associate/Collaborator by the Manufacturer or the bidder, as per the Employer's format.

(d) **Attachment 3(P): deleted**

(e) **Attachment 4(P): Local Representation**

If a foreign bidder has engaged an Indian agent, it will be required to give the following details in its bid as per the format enclosed in the Bidding Documents.

- (a) The name and address of the local agent;
- (b) What Service the agent renders; and
- (c) The fixed amount of remuneration for the agent included in the offer;

The agency commission shall be indicated in the space provided for in this Attachment and will be paid to the bidder's agent in India in Indian Rupees using the SBI Telegraphic Transfer Buying Market rate of exchange ruling on the date of Notification of Award and shall not be subject to any escalation or any further exchange variation, whatsoever and will be payable pro-rata along with the base contract price payment.

(f) **Attachment 5(P): Price Adjustment Data**

Details regarding Price Adjustment as per the Employer's format.

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- (g) **Attachment 6(P):** Check List of documents to be submitted for Envelope-II (Price) Bid
- 8.3 **Price envelope should not contain any matter in respect of Technical and / or Commercial aspects other than the details specifically sought in the Price envelope. If the Technical/commercial matters indicated in Price envelope are found to be in contradiction with the details furnished in Techno-Commercial envelope, the details furnished in Techno- Commercial envelope shall prevail.**
- 8.4 The Envelope-I (Techno-Commercial Bid) & Envelope-II (Price) Bid submitted by the Bidder should be without any deviations and strictly in conformity with the provisions of all bidding documents and amendments/ addenda/ corrigenda/errata/clarifications to the Bidding Documents issued by Employer prior to deadline for submission of bids. **A conditional Bid shall run the risk of rejection.**

9 Bid Form and Price Schedules

The Bidder shall complete the Bid Form, Attachments to Price envelope and the appropriate BOQ (excel sheet) along with Price Schedules (if provided) furnished in the bidding documents as indicated therein, following the requirements of ITB Clauses 10 and 11.

10 Bid Prices

- 10.1 Unless otherwise specified in the Technical Specifications, Bidders shall quote for the entire facilities on a “single responsibility” basis such that the total bid price covers all the Contractor’s obligations mentioned in or to be reasonably inferred from the bidding documents in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation, commissioning, Completion of the facilities and conductance of Guarantee tests for the facilities including supply of mandatory spares (if any). This includes all requirements under the Contractor’s responsibilities for testing, pre-commissioning and commissioning of the facilities, conducting Guarantee tests and, where so required by the bidding documents, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the bidding documents, all in accordance with the requirements of the General Conditions of Contract and Technical Specifications.
- 10.2 Bidders are required to quote the price in Price Bid for the commercial, contractual and technical obligations outlined in the bidding documents.
- 10.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules of Price Bid. The Bidders shall present their prices in the following manner:

Separate numbered Schedules shall be used for each of the following elements and all the price schedules shall be uploaded.

Schedule No. 1 Plant and Equipment including Type Tests charges and Mandatory Spares to be supplied from Abroad

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Schedule No. 2 Plant and Equipment including Type Tests charges and Mandatory Spares to be supplied from within the Employer's Country

Schedule No. 3 Local Transportation including Port handling, Port clearance, Port charges, Inland insurance and other local costs incidental to delivery of Plant & Equipment and Mandatory Spares

Schedule No. 4 Installation Services including Erection and Civil / Structural Works (as applicable), Insurance covers other than inland transit insurance, **Safety Aspects/Compliance to Safety Rules** and other services as specified in the bidding documents.

Schedule No. 5 NOT USED

Schedule No. 6 Recommended Spare Parts

Schedule No. 7 Good and Service Tax (GST), applicable on schedule 2, 3 & 4, not included in bid price.

Bidders shall note that the plant and equipment included in Schedule No.1 and 2 above shall exclude all materials used in civil, building and other construction works, if any. All such materials shall be included and priced in BOQ against the items indicated therein in respect of Schedule No. 4

Bidders may note that individual Price Schedules (i.e. Schedule Nos. 1, 2, 3, 4, & 7) containing breakup of prices, need not be furnished along with the Bid/BOQ. The bidder shall furnish the same as per specified format prior to award following the requirements of clause 10.3.3 below.

10.3.2 Further, Bidders are required to furnish the following Schedules (as per format), along with BOQ:

Schedule No. 6 Recommended Spare Parts

Schedule No. 9 Schedule of Unit Rates

10.3.3 **Prior to award**, successful Bidder shall furnish the detailed break-up of their BOQ price in the Schedules (as per format) in respect of Schedule Nos. 1, 2, 3, 4, & 7 (as mentioned at clause 10.3.1 above) along with Schedule No. 8A (Break up of Type Tests charges quoted in Schedule-1) & Schedule No. 8B (Break up of Type Tests charges quoted in Schedule-2).

10.3.4 The quoted prices as per the BOQ (excel format) only shall be used for the purpose of evaluation & award. Bidder to note that Schedules mentioned in clause 10.3.3 shall not be submitted along with Bid/BOQ. In case, Schedules mentioned in clause 10.3.3 are submitted along with Bid/BOQ, the same shall not be given effect to by Employer. Only the schedules submitted **prior to award** following the requirements of clause 10.3.3 above, will be considered to be valid for the purpose of the bid.

Further, if there is discrepancy between the BOQ and 'break-up of prices in Schedules' furnished prior to award, the Price quoted in BOQ shall prevail. The detailed price break-up

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in Schedule shall be corrected, if required, by the successful bidder to match the Item-wise prices as per the BOQ sheet.

10.4 In the Schedules, Bidders shall give the required details and a breakdown of their price Bid as follows:

- (a) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from abroad (Schedule No. 1) shall be quoted on CIF (Indian Port-of-Entry) basis. In addition, the FOB Price and the Type Test Charges shall also be indicated.

Further, Bidders seeking qualification on the basis of association / collaboration with manufacturer(s) of particular equipment(s) are required to quote the price of such equipment(s) including spares on CIF (Indian port-of-entry) basis, if the items are to be imported by the manufacturer or the bidder. In case, such equipment and spares are not quoted by the bidder on CIF (Indian port-of-entry) basis, then Employer shall assess the CIF (Indian port-of-entry) price of such equipment and mandatory spares for the purpose of evaluation.

Further, the prices for Mandatory Spares shall be quoted in compliance with the requirements as per the list of Mandatory Spares specified in the Technical Specifications and the Price Schedule-1 of the Bidding documents.

- (b) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country (Schedule No. 2) shall be quoted on EXW (Ex-Factory, Ex-Works, Ex-Warehouse or Off-the-Shelf, as applicable) basis and shall be inclusive of all costs as well as duties and taxes paid or payable on components and raw materials incorporated or to be incorporated in the facilities.

Further, the prices for Mandatory Spares shall be quoted in compliance with the requirements as per the list of Mandatory Spares specified in the Technical Specifications and the Price Schedule-2 of the Bidding documents.

- (c) Local Transportation, Inland Transit Insurance, Port Clearance, Port Handling and Port Charges, Custom reconciliation and other local costs incidental to delivery of the Plant and Equipment including Mandatory Spares shall be quoted in Schedule-3.

- (d) Installation Services including Erection and Civil & Allied Works (as applicable) shall be quoted separately (Schedule No. 4) and shall include rates or prices for all labour, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, charges for insurance covers other than inland transit Insurance, charges for Safety Aspects/Compliance to Safety Rules including operations and maintenance services (if applicable), the provision of operations and maintenance manuals, training of employer's personnel, etc., and other services, as identified in the Bidding Documents, as necessary for the proper execution of the Installation Services.

- (i) Bidders are advised to price their bids in such a manner that Installation Price Component of the bid price (excluding Civil/Structural works price) should not be less than 15% of the cumulative total of FOB Price of Main Equipment indicated in Schedule No.1 and Ex-works Price of Main Equipment indicated in Schedule No.2.

In case the Installation Price is below the minimum percentage specified above, the amount by which it is lower shall be retained proportionately from the FOB & Ex-Works component of Contract price while releasing payments due on receipt of equipment, and no interest shall be payable on the

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retained amount. The aforesaid retained amount shall be paid on pro-rata basis upon completion of installation of the respective equipment and its certification by the Project Manager.

(If Prices are quoted in foreign currency then SBI Bills Selling exchange rate as on the deadline set for submission of bids shall be considered for the purpose of computing installation percentage /retention amount).

- (ii) ~~Bidders are advised to price their bids in such a manner that the Civil Works Price Component of the bid price (including Site Fabricated Structural works price) should not be less than 20% and should not be more than 30% of the cumulative total of FOB Price of Main Equipment indicated in Schedule No.1 and Ex-works Price of Main Equipment indicated in Schedule No.2.~~

~~In case the Civil Works Price (including Site Fabricated Structural works price) is below the minimum percentage specified above, the amount by which it is lower shall be retained proportionately from the FOB & Ex-Works component of Contract price while releasing payments due on dispatch of equipment, and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid on pro-rata basis upon completion of Civil Works including Structural works (if any) corresponding to the respective equipment and its certification by the Project Manager.~~

~~In case the Civil Works Price (including Site Fabricated Structural Works Price) is above the maximum percentage specified above, the amount by which it is higher shall be retained while releasing progressive payments due on completion of civil works (including Site Fabricated Structural works), and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid along with payment due on completion of Trial Operation / Completion of Facilities.~~

- (iii) Bidders are advised to price their bids in such a manner that the component for 'Amount linked to Safety Aspects/ compliance to Safety Rules' should not be less than 2 % of the cumulative total of Service Portion of the Contract, i.e. Civil + Installation/ Erection + Structural Works. In case 'Amount linked to Safety Aspects/ compliance to Safety Rules' is less than aforesaid minimum percentage specified of the cumulative total of Service Portion of the Contract, i.e. Civil + Installation/ Erection + Structural Works, the amount by which it is lower shall be retained proportionately from the other components of Schedule-4 of the Contract price while releasing payments of each RA bill. No interest shall be payable on the amounts linked to Safety Aspects / Compliance to Safety Rules including aforesaid retained amount. The amounts linked to Safety Aspects / Compliance to Safety Rules including aforesaid retained amount shall be payable in part or full based on safety compliance duly certified by Project Manager and Safety-in-charge on quarterly basis.

(If Prices are quoted in foreign currency then SBI Bills Selling exchange rate as on the deadline set for submission of bids shall be considered for the purpose of computing percentage linked to safety aspects/retention amount).

- (e) Recommended Spare parts shall be quoted separately in Schedule 6 on CIF/EXW basis in accordance with subparagraph (a) or (b) above. Local Transportation Charges including Inland Transit Insurance and Port Charges etc., for

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recommended spares shall also be quoted in Schedule-6 and shall not be included in Schedule No. 3 by the bidder.

- (f) The prices quoted in Schedule Nos. 2, 3 & 4 shall be inclusive of all Taxes, Duties, Levies & charges, except Goods and Services Tax (GST), payable in the Employer's country as of seven (7) days prior to the deadline for submission of bids. Further, all Taxes, Duties, Levies & Charges on the Materials incorporated in Erection and Civil & Allied Works (as applicable) shall also be included in the prices quoted in Schedule No. 4 & no Separate payment on this account, whatsoever, shall be made by Employer.

Goods and Services Tax (GST) applicable on goods and services specified in Schedule Nos. 2, 3 & 4 shall not be included in respective schedules, but shall be quoted separately in Schedule No. 7. The Goods & Services Tax (GST) quoted by the bidder in Schedule No. 7 shall be as applicable in the Employer's country as on seven (7) days prior to the deadline for submission of Bids. The detailed breakup of items along with rate of GST is required to be submitted prior to the placement of award.

Customs Duty/ Import duty and Goods and Services Tax (GST) applicable on goods and services specified in Schedule No. 1 shall not be included in the schedule.

The Employer, as a consignee shall furnish promptly necessary clarifications and documents as may be required to be furnished by the consignee for the purpose of customs clearance.

Due Input Tax credits under GST as per the relevant Govt. Policy, wherever applicable, shall be taken into account by the Bidder while quoting his price.

- 10.5 The terms EXW, FOB, CIF, etc., shall be governed by the rules prescribed in the current edition of Incoterms, published by the International Chamber of Commerce, 33-43 avenue du Président Wilson 75116, Paris, France.

10.6 Custom Duty Benefits for Power Projects

10.6.1 Bidder may ascertain the availability of Custom Duty benefits under the Customs Tariff Act, available on import of Raw Materials/ Sub- Assembly/ Items, which are required for the manufacture and supply of plant and equipment to be incorporated in the facilities under the Contract.

- for Power Projects

Bidder may ascertain the availability of Custom Duty benefits under Chapter 98.01 of the Customs Tariff Act, available on import of Raw Materials/ Sub- Assembly/ Items, which are required for the manufacture and supply of plant and equipment to be incorporated in the facilities under the Contract. The Employer shall issue the required Certificate, as per relevant policies of the Govt. of India, to facilitate the bidders to avail any such benefit under the Contract. For issuance of such Certificate by the Employer, the bidders shall be required to indicate the import content included in their bid price, in Attachment-1P of Price Bid. The relevant Certificate will be issued on this basis only.

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In addition, Bidder may also like to ascertain the availability of Custom Duty Benefits available for import of construction Equipment, if any, as per the extant Customs Acts & Notification of Govt. of India. Where the Bidder has quoted taking into account the Custom Duty benefits available for import of Construction Equipment, he must give all information required for issue of relevant Certificate by Employer in Attachment-1A(P). The relevant Certificate will be issued on this basis only and no subsequent change will be permitted.

However, if the above certificates are required to be issued by any department/ministry of Government of India or State Government where the Project is located other than Employer, the bidder shall itself be responsible for obtaining such certificate from the concerned department/ministry. In such a case, the Employer may issue a letter of recommendation.

Further, the bidders shall themselves be solely responsible for availing the above benefits, which they have considered in their bid. In case of failure of the bidders to receive the benefits partly or fully from the Govt. of India and/or in case of any delay in receipt of such benefits and/or withdrawal of such benefits by the Govt. of India, the Employer shall neither be liable nor responsible in any manner whatsoever.

10.7 Price Basis

Prices quoted by the Bidder shall be subject to adjustment during performance of the Contract to reflect changes in the cost of labour, material, etc. in accordance with the procedures specified in relevant appendix to the Form of Contract Agreement (Price Adjustment). A bid submitted with a fixed price quotation will not be rejected, but the price adjustment will be treated as zero. The price adjustment provision will not be taken into consideration in bid evaluation. Bidders must indicate the name, source, origin of labour and material indices along with their base values in relevant attachment (Price Adjustment) to Bid.

11.0 Bid Currencies

11.1 Prices shall be quoted in the following currencies:

- (a) Plant and equipment including type tests and mandatory spares covered under ITB Sub-Clauses 10.4 (a) & 10.4 (b) and EXW/CIF price of recommended spare parts covered under ITB Sub-Clause 10.4 (e) shall be quoted in any currency subject to 11.1 (d). Domestic Bidders while quoting in foreign currency must comply with the requirement as laid down by Govt. of India from time to time.
- (b) Local transportation, inland transit insurance and other local costs incidental to delivery of the plant and equipment including mandatory spares covered under ITB Sub-Clause 10.4 (c) and Installation services covered under ITB Sub-Clause 10.4 (d) shall be quoted in local currency. However, foreign component, if any, of

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Installation Services (excluding civil, structural & allied works) covered under ITB Sub-clause 10.4 (d) may be quoted in foreign currency.

- (c) Local Transportation, inland transit insurance and other local costs incidental to delivery of recommended spares covered under ITB Sub-Clause 10.4 (e) shall be quoted in Local Currency.
- (d) If the Bidder wishes to be paid in a combination of amounts in different currencies, it may quote its price accordingly, but use only three foreign currencies (i.e. USD, Euro & JPY only), other than the local content portion of the bid price which shall be quoted in Local currency only.
- (e) Not used.

12.0 **Bid Security**

12.1 The Bidder shall furnish, as part of its Bid, a Bid Security in a separate sealed envelope in the amount and currency as stipulated in the Bid Data Sheet (BDS). In case bid security amount is deposited as EFT, Proof of e-payment of Bid Security, shall be submitted in the e-tendering portal or in a separate sealed envelope.

12.2 The Bid Security shall, at the Bidder's option, be in the form of Electronic Fund Transfer (EFT)/ irrevocable Letter of Credit or a bank guarantee from any of the banks specified in the Bid Data Sheets or an Insurance Surety Bond from an Insurer as per guidelines issued by Insurance Regulatory and Development Authority of India (IRDAI).

Upon successful e-payment of the Bid Security on the NTPC e-tender portal, an e-receipt shall be generated by the system, a copy of which is to be submitted by the bidder as a part of its bid, in the e-tendering portal or in a separate sealed envelope, as a proof of e-payment of Bid Security.

In case of Foreign Bidders, the Bid Security can be from any other Bank also in addition to the Banks specified in the Bid Data Sheets. If the Bank Guarantee is from a Bank not specified in the Bid Data Sheets, then the Bank Guarantee shall be confirmed by any of the Banks specified in the Bid Data Sheets.

The format of the Bank Guarantee/ Insurance Surety Bond shall be in accordance with the form of bank guarantee/ Insurance Surety Bond towards bid security included in the Bidding Documents. Bid Security shall remain valid for a period of forty-five (45) days beyond the original Bid validity period and beyond any extension of bid validity subsequently requested under relevant clause of ITB.

12.3 Not used.

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- 12.4 Any bid not accompanied by an acceptable bid security in a separate sealed envelope shall be rejected by the employer as being non-responsive. In case, the bid security is submitted as EFT, bidder to submit the proof of e-payment of bid security either in separate sealed envelope or in the e-tendering portal.
- 12.5 BG against Bid Security issued by a Bank outside India needs to bear stamp duty of appropriate value applicable to the place in NTPC where BG is to be submitted. The BG may be got adjudicated by the employer from Collector of Stamps, within 3 months of arrival of BG in India. Expenses incurred in this regard shall be borne by Employer.
- Insurance Surety Bond against Bid Security issued by an Indian Insurance company outside India needs to bear stamp duty of appropriate value applicable to the place in NVVN where Insurance Surety Bond is to be submitted. The Insurance Surety Bond may be got adjudicated by the employer from Collector of Stamps, within 3 months of arrival of Insurance Surety Bond in India. Expenses incurred in this regard shall be borne by Employer.
- 12.6 Subject to clause 12.8 below, the Bid Security of the Bidder whose Techno-Commercial Bid has not been found acceptable, shall be returned along with letter communicating rejection of Techno-Commercial Bid. The Bid Security of the bidders who are unsuccessful after opening of Price Bids shall be returned expeditiously.
- 12.7 The Bid Security of the successful Bidder to whom the contract is awarded will be returned when the said Bidder has signed the Contract Agreement and has furnished the required Performance Securities pursuant to relevant clauses of ITB.
- 12.8 The Bid Security may be forfeited:
- (a) if the Bidder withdraws or varies its Bid during the period of Bid Validity;
 - (b) If the Bidder does not accept the correction of its Bid Price pursuant to ITB Sub-Clause 26.2;
 - (c) If the Bidder refuses to withdraw, without any cost to the Employer, any deviation, variation, additional condition or any other mention anywhere in the bid, contrary to the provisions of bidding documents;
 - (d) In the case of a successful Bidder, if the Bidder fails within the specified time limit to furnish the required Contract Performance Guarantee/Security Deposit in accordance with relevant clause of ITB.

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- (e) If the bidder/his representatives commits any fraud while competing for this contract pursuant to Fraud Prevention Policy of NTPC.
- (f) In case the Bidder/Contractor is disqualified from bidding process in terms of Section 3 and 4 of Integrity Pact.

12.9 Confirmation of BG through Structured Financial Messaging System (SFMS)/SWIFT

While issuing the physical BGs, the Bidder's Bank shall also send electronic message through secure SFMS (in case of BGs issued from within India) or SWIFT (in case of BGs issued from outside India) to Employer's Beneficiary Bank whose details are provided herein below:

- (i) Bank Name: ICICI Bank Limited
- (ii) Branch: CONNAUGHT PLACE BRANCH
- (iii) Bank Address: 9A, PHELPS BUILDING, INNER CIRCLE, NEW DELHI-110001
- (iv) IFSC Code: ICIC0000007

BG issuing/amending bank must send the BG advice in the form of message format via SFMS (Structured Financial Messaging System) as provided by RBI. The format of the message for confirmation of the BG shall be as below:

BG advising message: IFN 760COV/ IFN 767COV via SFMS
Field Number: Particulars (to be mentioned in Row 1)
7037: NVVNBG8910 (unique identifier)

12.10.1 Wherever the submission of Bid Security has been prescribed in the Bidding Documents, the Bid must be accompanied by the Bid Security in a separate envelope. The envelope must be clearly marked on top to evidence the presence of bid security.

In case the Bid Security is deposited by the Bidder/ vendor at the tendering portal through e-payment, as applicable, bidder to submit the proof of e- payment of bid security either in separate envelope or in the e-tendering portal.

12.10.2 In case of Bidders opting for Bank Guarantee as Bid Security but unable to submit the Original Bank Guarantee in physical form at the tender opening location, before the deadline for submission of bids, following shall also be considered acceptable, subject to para 12.10.2.1 below:

- (i) The issuing bank shall intimate through their own official e-mail id to concerned C&M department with a copy to Bidder regarding issuance /

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extension of Bank Guarantee (BG) along with following documents, before the deadline of submission of bids: -

- a) The scanned copy of the BG.
- b) SFMS / SWIFT message acknowledgement copy sent to Employer / Employer's banker stating the date of sending.
- c) An undertaking from the issuing Bank strictly as per format enclosed at Annexure-III to BDS.

SFMS / SWIFT message must be sent to the Employer/Employer's bank, details of which are mentioned in Bidding documents.

- (ii) Bidders shall also be required to upload the scanned copy of the BG on e-Tender Portal in Fee Cover.

12.10.2.1 The bidder shall be required to submit all the documents in the manner as specified at para 12.10.2 above, to reach Employer before the deadline for submission of bids, failing which its bid shall be rejected as being non-responsive.

In such a case, Bidder shall also be required to submit the Original BG in physical form to reach Employer at the address mentioned in Bidding Documents, not later than 10 days from the date of submission of Techno-Commercial bids or before the Price Bid opening, whichever is earlier, failing which its bid shall be rejected and not considered for further evaluation.

13.0 **Period of Validity of Bids**

13.1 The Bid (comprising Techno-Commercial and Price envelope) shall remain valid for a period of one hundred eighty (180) days from the deadline set for submission of Bid. The bid valid for a shorter period shall be rejected by Employer as being non responsive.

13.2 The bidder is required to keep the prices of recommended spares covered under Price Schedule No. 6 valid for a period of six (6) months after Notification of Award for main equipment and mandatory spares.

13.3 In exceptional circumstances, Employer may solicit the Bidder's consent to an extension of the bid validity period. The request and responses thereto shall be made in writing by post, or e-mail. If a Bidder accepts to extend the period of bid validity, the validity of bid security shall also be suitably extended. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request will not be required nor permitted to modify its bid.

14.0 **Format and Signing of Bid**

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The bid including all documents uploaded at the e-Tender portal shall be digitally certified using Class-III signature by a duly authorised representative of the Bidder to bind him to the contract. The authorization shall be indicated by written power of attorney as per ITB Clause 8.1.1 (b) and shall be submitted in physical form in a separate sealed envelope prior to the deadline for submission of bids.

D. Submission of Bids

15.0 Submission of Bids

The Bid [comprising the Bid Form as per Section-VII, Part 1 of 3 and Part 2 of 3, together with its Attachments (Techno-commercial and price) and BOQ/Price Schedules] shall be submitted simultaneously at the e-tender portal through e-tender mode in the manner specified elsewhere in bidding document. No Manual/ Physical Copy of the Bid shall be acceptable, except the documents specified to be submitted in physical form as per ITB Clause 8.1.1.

Bidder shall upload the completed Bid Form, Attachments pertaining to Techno-commercial envelope along with all annexures under 'Technical Cover' at the e-Tender Portal.

The Attachments to Price envelope, duly completed together with BOQ (excel format) shall be uploaded in 'Finance cover' at the e-Tender Portal. Further, the detailed break-up of BOQ price in the Price Schedules (if provided along with Bidding documents) shall also be furnished in 'Finance cover'. Bidders may note that Attachments to Price Envelope together with BOQ (excel sheet)/Price Schedule **should not be** uploaded in the 'Technical cover' at the e-Tender Portal.

Bidder to further ensure that documents uploaded online are being downloaded properly. Employer shall not be responsible for corrupt files, if any, uploaded online by bidder. Further file related to particular Attachment/Schedule including their annexures/ appendices, if any, shall be given name of that Attachment/Schedule only.

15.1 Sealing and Marking of Physical Documents

15.1.1 Documents to be submitted in physical form (as brought out at ITB clause 8.1.1) shall be sealed and marked in the following manner:

- (i) The bid security furnished in accordance with ITB Clause 12 shall be sealed in a separate envelope duly marking the envelope as "ATTACHMENT-1: BID SECURITY".
- (ii) All other Original documents required to be submitted in physical form in line with ITB Clause 8.1.1 shall be sealed in a separate envelope duly

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marking the envelope as “Techno-Commercial Bid – Physical Documents”

The envelopes shall then be sealed in an outer envelope.

- 15.1.2 The inner and outer envelopes shall:
- (a) be addressed to the Employer at the address given in the Bid Data Sheet (BDS), and
 - (b) bear the Package name indicated in the Bid Data Sheet (BDS), the Invitation for Bids number indicated in the Bid Data Sheet (BDS), and the statement "DO NOT OPEN BEFORE [date]," to be completed with the time and date specified in the Bid Data Sheet (BDS), pursuant to ITB clause 16 i.e. 'Deadline for Submission of Bids'.
- 15.1.3 The inner envelopes shall also indicate the name and address of the Bidder.
- 15.1.4 If the outer envelope is not sealed and marked in the manner specified above, the Employer will assume no responsibility for its misplacement.

16.0 Deadline for Submission of Bids

- 16.1 Bids (both Techno-Commercial and Price) must be submitted online at e-tender portal not later than the time and date stated in the e-Tender Portal.
- 16.2 The physical documents in line with ITB Clause 8.1.1 shall be submitted before stipulated bid submission time at the address specified in BDS and Employer shall not be liable for loss/non-receipt/late receipt of above documents in postal transit.
- 16.3 The Employer may, at its discretion, extend this deadline for submission of bids by amending the bidding documents in accordance with ITB Sub-Clause 6.0 i.e. 'Amendment to Bidding Documents', in which case all rights and obligations of Employer and Bidders will thereafter be subject to the deadline as extended.

17.0 Not used

18.0 Modification and Withdrawal of Bids

- 18.1 The bidder may withdraw or modify its bid after the bid submission as per provision available in the e-tender portal. However, no bid can be withdrawn or modified subsequent to the deadline prescribed for submission of bids. Bidder may modify and re-submit its bid prior to the deadline prescribed for submission of bids. However, if the bidder once withdraws its bids, it cannot be submitted again.
- 18.2 No bid may be withdrawn in the interval between the bid submission deadline and the expiration of the bid validity period specified in ITB Clause 13. Withdrawal of a bid during this interval may result in the Bidder's forfeiture of its bid security, pursuant to ITB Sub-Clause 12.8(a).

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E. Bid Opening and Evaluation

19.0 Opening of Bids

19.1 Envelope-I (Techno-Commercial) Bid Opening

19.1.1 The Employer will first open Techno-Commercial Bid online in the presence of bidders' representatives who choose to attend the opening at the time, on the date and at the place specified in the Bid Data Sheet (BDS). In the event of the specified date for the opening of bids being declared a holiday for Employer, the bids will be opened at the appointed time on the next working day. All important information and other such details as Employer, at its discretion, may consider appropriate, will be announced at the opening.

19.1.2 In case requisite Bid Security pursuant to ITB Clause 12, Tender Fee as per clause 8.0, and/or Integrity Pact (IP) as per provision of Integrity Pact specified in ITB Clause 41.0 are not submitted before the stipulated bid submission closing date and time then Bid shall be rejected by the Employer as being non-responsive and shall not be opened.

19.2 Envelope-II (Price) Bid Opening

19.2.1 After the evaluation process of Techno-Commercial bid is completed, Employer will inform in writing the eligible Bidders regarding date, time and venue set for the opening of Price Bid. Bidders, whose Techno-Commercial Bid is not substantially responsive or does not meet the Qualification Requirements set forth in the bidding documents or who are debarred under Employer's **Policy for Debarment from Business Dealings** relating to some other tender/contract, shall also be informed in writing that their bid has been rejected and their bid security shall be returned, in accordance with ITB clause 12.6.

19.2.2 Price bids of those Bidders, who have been considered qualified and whose Techno-Commercial Bid found to be responsive, will be opened online in presence of the Bidder's authorised representatives who choose to attend. The Employer will open Price Bids at the time, on the date and at the place specified by the Employer. In the event of the specified date for the opening of bids being declared a holiday for the Employer, the bids will be opened at the appointed time on the next working day. All important information and other such details as the Employer, at its discretion, may consider appropriate, will be announced at the opening.

19.2.3 **The participating bidders will be able to view the bid prices of all the bidders after online opening of Price Bids by Employer.**

19.2.4 **Reverse Auction**

If so permitted in the Bid Data Sheet (BDS), Reverse Auction shall be carried out after the opening of Price Bids as per methodology defined in the BDS.

20.0 Clarification on Bids

During bid evaluation, the Employer may, at its discretion, ask the Bidder for a clarification of its bid including documentary evidence pertaining to the reference plants declared in the bid for the purpose of meeting Qualifying Requirement specified in Bid Data Sheet. The request for clarification and the response shall be in writing, and no change in the price or substance of the bid including substitution of

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reference plants in the bid by new/additional plant for conforming to Qualifying Requirement shall be sought, offered or permitted.

21.0 PRELIMINARY EXAMINATION OF ENVELOPE-I (TECHNO-COMMERCIAL) BID

21.1 Employer will examine the bids to determine whether they are complete, whether required securities have been furnished, whether the documents have been properly signed and whether the bids are generally in order.

21.2 Prior to the detailed evaluation, EMPLOYER will initially determine whether each Techno- Commercial bid is of acceptable quality, is generally complete and is substantially responsive to the bidding documents. For purposes of this determination, a substantially responsive bid is one that conforms to all the terms, conditions and specifications of the bidding documents without material deviations, objections, conditionalities or reservations. A material deviation, objection, conditionality or reservation is one (i) that affects in any substantial way the scope, quality or performance of the contract; (ii) that limits in any substantial way, inconsistent with the bidding documents, the Employer's rights or the successful Bidder's obligations under the contract; or (iii) whose rectification would unfairly affect the competitive position of other Bidders who are presenting substantially responsive bids.

21.3 **No deviation, whatsoever, is permitted by Employer to any provisions of Bidding Documents. The Bidders are advised that while making their Bid proposals and quoting prices, all conditions may appropriately be taken into consideration.** Bidders shall certify their compliance to the complete Bidding Documents by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of above condition shall be considered as Bidder's confirmation that any deviation to any Provisions of the bidding documents found anywhere in their Bid Proposal, implicit or explicit, **shall stand unconditionally withdrawn, without any cost implication whatsoever to the Employer, failing which the bid shall be rejected and bid security shall be forfeited.**

21.3.1 The Employer may waive any minor informality, nonconformity or irregularity in a bid that does not constitute a material deviation.

21.4 The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence. If a bid is not substantially responsive, it will be rejected by Employer, and may not subsequently be made responsive by the Bidder by correction of the nonconformity

22.0 QUALIFICATION

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22.1 Bidders shall certify their compliance on "Qualifying Requirements" of Employer by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of above GTE shall be considered as bidder's confirmation to the following conditions:

- (a) The number of reference Plants/Orders quoted by Bidder in Attachment- 3A of the bid, for establishing compliance to the specified Qualifying Requirement (QR), are in accordance with the provision specified in Bid Data Sheet.
- (b) The reference Plants/ Orders/ declared, shall only be considered for evaluation/ establishing compliance to Qualifying Requirement (QR). Any reference Plants/Orders declared more than as specified in Bid Data Sheets shall not be considered for evaluation/establishing compliance to Qualifying Requirements.
- (c) No change or substitution in respect of reference Plants/Orders for meeting the specified Qualifying Requirement (QR) shall be offered by the bidder.

Bidders are required to furnish the details of the past experiences based on which selection is to be made as per format enclosed in the bidding documents for the same and enclose relevant documents like copies of authentic work order, completion certificate, agreements etc. supporting the details/data provided in the format. No claims without supporting documents shall be accepted in this regard. However if any of the reference work pertains to the Contract(s)/Works executed by Bidder for EMPLOYER in the past then in respect of such Contract(s)/ Works Bidder shall not be required to enclose Client Certificate (s) along with its bid.

22.2 The Employer will ascertain to its satisfaction whether bidders determined as having submitted responsive Techno-Commercial bids are qualified to satisfactorily perform the contract in terms of the qualifying requirements stipulated in the Bid Data Sheet (BDS). The determination will take into account the Bidder's financial, technical and production capabilities and past performance. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB Sub-Clause 8.1.2 (a), as well as such other information as the Employer deems necessary and appropriate.

Notwithstanding anything stated anywhere else in the bidding documents, Employer reserves the right to seek in writing information relating to qualifying requirements in addition to details contained in the bid. The bidder shall furnish required information promptly to the Employer.

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22.3 A negative determination will result in rejection of the Bidder's Techno-Commercial Bid in which event Employer will not open the Price Bid of the concerned bidder and his bid security shall be returned in accordance with ITB clause 12.6.

22.0 **QUALIFICATION**

22.1 Bidders shall certify their compliance on "Qualifying Requirements" of Employer by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of above GTE shall be considered as bidder's confirmation to the following conditions:

- (a) The number of reference Plants/Orders quoted by Bidder in Attachment- 3A of the bid, for establishing compliance to the specified Qualifying Requirement (QR), are in accordance with the provision specified in Bid Data Sheet.
- (b) The reference Plants/ Orders/ declared, shall only be considered for evaluation/ establishing compliance to Qualifying Requirement (QR). Any reference Plants/Orders declared more than as specified in Bid Data Sheets shall not be considered for evaluation/establishing compliance to Qualifying Requirements.
- (c) No change or substitution in respect of reference Plants/Orders for meeting the specified Qualifying Requirement (QR) shall be offered by the bidder.

Bidders are required to furnish the details of the past experiences based on which selection is to be made as per format enclosed in the bidding documents for the same and enclose relevant documents like copies of authentic work order, completion certificate, agreements etc. supporting the details/data provided in the format. No claims without supporting documents shall be accepted in this regard. However if any of the reference work pertains to the Contract(s)/Works executed by Bidder for EMPLOYER in the past then in respect of such Contract(s)/ Works Bidder shall not be required to enclose Client Certificate (s) along with its bid.

22.2 The Employer will ascertain to its satisfaction whether bidders determined as having submitted responsive Techno-Commercial bids are qualified to satisfactorily perform the contract in terms of the qualifying requirements stipulated in the Bid Data Sheet (BDS). The determination will take into account the Bidder's financial, technical and production capabilities and past performance. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB Sub-Clause 8.1.2 (a), as well as such other information as the Employer deems necessary and appropriate.

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Notwithstanding anything stated anywhere else in the bidding documents, Employer reserves the right to seek in writing information relating to qualifying requirements in addition to details contained in the bid. The bidder shall furnish required information promptly to the Employer.

22.3 A negative determination will result in rejection of the Bidder's Techno-Commercial Bid in which event Employer will not open the Price Bid of the concerned bidder and his bid security shall be returned in accordance with ITB clause 12.6.

23.0 EVALUATION OF ENVELOPE-I (TECHNO-COMMERCIAL) BIDS

23.1 The Employer will carry out a detailed evaluation of the Techno-Commercial bids in order to determine whether the technical aspects are in accordance with the requirements set forth in the bidding documents. In order to reach such a determination, the Employer will examine and compare the technical aspects of the bids on the basis of the information supplied by the bidders, taking into account the following factors:

- (a) overall completeness and compliance with the Technical Specifications and Drawings; suitability of the facilities offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the bid. The bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected for non-responsiveness.
- (b) achievement of specified performance criteria by the facilities.
- (c) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services.
- (d) any other relevant factors, if any, listed in the Bid Data Sheets, or that the Employer deems necessary or prudent to take into consideration.
- (e) Functional Guarantees

Bidders shall submit declaration regarding functional guarantees (in relevant attachments) of the proposed facilities in response to the Technical Specifications. In case a minimum (or a maximum, as the case may be) level of functional guarantee is specified in the Technical Specifications for the bids to be considered responsive, bids offering plant and equipment with such functional guarantees less (or more) than the minimum (or maximum) specified may be rejected.

- (f) Compliance with the time schedule as specified in the bidding documents.
- (g) **Demonstration Parameters**

Bidders shall state the demonstration parameters for the proposed facilities in response to the Technical Specifications. In case a minimum (or a maximum,

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as the case may be) level of parameters is specified in the Technical Specifications for the bids to be considered responsive, bids offering plant and equipment with such functional guarantees less (or more) than the minimum (or maximum) specified may be rejected.

Bidder may note that deviations, variations and additional conditions etc. found anywhere in the bid, shall not be given effect to in evaluation and it will be assumed that the Bidder complies with all the conditions of Bidding Documents. In case the Bidder refuses to withdraw deviations, implicit or explicit, found anywhere in the bid, without any financial implication whatsoever to the Employer, the bid shall be rejected and bid security shall be forfeited.

24.0 **DELETED**

25.0 **DELETED**

26.0 **PRELIMINARY EXAMINATION OF ENVELOPE-II (PRICE) BID**

26.1 After opening of Price bids, The Employer will examine the Price bids to determine whether they are complete, whether any computational errors have been made, and whether the bids are generally in order.

26.2 **Arithmetical Correction**

Arithmetical errors will be rectified on the following basis.

The Bidder shall complete the Attachments to Price envelope and the appropriate BOQ (excel sheet) along with Price Schedules furnished in the bidding documents as indicated therein, following the requirements of ITB Clauses 10 and 11. The quoted prices as per the BOQ sheet (excel sheet) shall be used for the purpose of evaluation & award. However, if there is discrepancy between the BOQ (Excel sheet) and 'Price break-up in Price Schedule', the Price quoted in BOQ (excel sheet) shall prevail. The detailed price break-up of the BOQ in price schedule shall be corrected, if required, by the bidder to match the prices as per the BOQ sheet.

If the Bidder does not accept such correction of errors, its bid will be rejected, and the bid security will be forfeited in accordance with ITB Sub-Clause 12.8.

26.3 **Conversion to Single Currency**

To facilitate evaluation and comparison, the Employer will convert all bid prices, expressed in the amounts in various currencies in which the bid price is payable, to a single currency. The currency selected for converting bid prices to a common base for the purpose of evaluation, along with the type of transaction, source and date of the exchange rate to be used, is specified in the Bid Data Sheets.

27.0 **EVALUATION OF ENVELOPE-II (PRICE) BID**

27.1 The comparison shall be of the EXW Price of Plant and Equipment including Type Test Charges and Mandatory Spares offered from within the Employer's country, such price to include all costs as well as duties and taxes paid or payable on components and raw materials incorporated or to be incorporated in the Plant and Equipment including Mandatory Spares plus the price of the CIF named port of destination (or CIP Border point or CIP named place of destination) of the Plant and Equipment including Type Test Charges and Mandatory Spares offered from outside the Employer's country, plus the cost of Local

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Transportation, Insurance Covers, all Installation Services including Civil, Architectural & Structural works, training charges, AMC / AMS (Annual Maintenance Services), amount linked to safety etc. required under the Contract, plus the Goods and Services Tax (GST) (applicable on goods and services quoted in Schedules-2, 3 & 4) specified by the Bidder in Schedule-7 in its Bid.

The Price of recommended spare parts quoted in Price Schedule No. 6 shall not be considered for evaluation of Bids.

27.2 The Employer's evaluation of a bid will take into account the following:

- (i) The bid prices indicated in Price Schedules Nos. 1 through 4;
- (ii) Price Schedule No. 7;
- (iii) The corrections pursuant to ITB sub-clause 26.2;
- (iv) Functional Guarantee on account for BEF.
- (v) Purchase preference pursuant to ITB Clause 28

27.3 **Not used**

27.4 Any adjustments in price that result from the above procedures shall be added, for purposes of comparative evaluation, to arrive at an "Evaluated Bid Price".

27.5 Evaluated bid price in Indian Rupees of each bid will be divided by Net output of the plant for that bid to arrive at evaluated bid price per MW and the bid with lowest evaluated bid price per MW shall be selected for award. Net output of the plant shall be $[n \times \text{Guaranteed Net output per module}]$ where "n" is the number of modules offered.

An illustrative method of evaluation as brought out above is explained below:

Illustrative Method of Evaluation

		-(Equivalent INR)-
1.	Quoted Bid Price without taxes & duties (after considering arithmetical corrections)	
(i)	CIF price including type test charges for equipment and mandatory spares (Schedule-1)	N1
(ii)	Ex-works price including type test charges for equipment and mandatory spares (Schedule-2)	N2
(iii)	Price for inland transportation including inland transit insurance for equipment and mandatory spares (Schedule-3)	N3
(iv)	Price for Installation Services/ Civil Works/ Others (Schedule-4)	N4
(v)	Total Price	N (N1+N2+N3+N4)
2.	Taxes & Duties (not included in 1 above)	
(i)	Customs Duty/ Import Duty and GST on CIF Price (Schedule-1) as on 07 days prior to bid submission.	P1
(ii)	GST (on Schedule 2, 3 & 4) as quoted in Schedule-7	P2
(iii)	Total	P (P1+P2)
3.	Loading for Functional Guarantee	BEF

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4.	Evaluated Bid Price	FEP (N+P + BEF)
5.	Net Output of Plant	P_{NP}
6.	Evaluated Bid Price per MW	FEP/ P_{NP}

$$P_{NP} = n \times (Y_{ccg})$$

P_{NP} = Net output of the Plant in MW for Bidder

Y_{ccg} = Guaranteed Net output per module as defined in Technical Specifications declared by bidder in Technical Data sheet.

n = number of module

The Bidder with lowest Evaluated Bid Price per MW, subject to purchase Preference will be selected for award.

Note: Aforesaid method of evaluation shall be equally applicable for all bidders.

28. PREFERENCE TO MAKE IN INDIA AND GRANTING OF PURCHASE PREFERENCE TO LOCAL SUPPLIERS

Purchase Preference shall be applicable as specified in **Annexure II to Section III (Bid Data Sheet)** of Bidding Documents.

29. Contacting the Employer

- 29.1 Subject to ITB Clause 20, no Bidder shall contact the Employer on any matter relating to its bid, from the time of the opening of bids to the time the contract is awarded.
- 29.2 Any effort by a Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in rejection of the Bidder's bid.

F. Award of Contract

30. Award Criteria

- 30.1 Subject to ITB Clause 31 (Employer's Right to Accept any Bid and to Reject any or all bids) and Employer's Policy for Debarment from Business Dealings, the Employer will award the Contract to the successful Bidder [whose Techno-Commercial bid has been determined to be substantially responsive and the bidder is determined to be qualified to perform the Contract satisfactorily and whose Price Bid is determined to be the lowest evaluated bid after the Reverse Auction Process (if applicable)], as per methodology indicated in Annexure-IV to BDS.

No contract shall be awarded to a bidder against whom a Debarment Order has been issued as per Employer's Policy for Debarment from Business Dealings.

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- 30.2 The Bidder will be required to comply with all requirements of the Bidding Documents and subsequent amendments thereof, without any extra cost to the Employer, failing which his bid security will be forfeited.
- 30.3 Employer reserves the right to vary the quantity of any of the Spares and/or delete any item of Spares altogether at the time of Award of Contract. Further, employer may place the award for any mandatory spares with NOA and/or within three years from the date of NOA as per mutually agreed dispatch schedule and as per the price quoted by the bidder in their bid in accordance with the relevant clauses.
- 30.4 The mode of contracting with the successful bidder will be as per stipulation outlined in GCC Clause 3.6 and briefly indicated below:

In the case of successful Domestic Bidder, the award shall be made as follows:

- (i) First Contract: For CIF (Indian port of entry) supply of plant and equipment including type test charges and mandatory spares to be supplied from abroad.
- (ii) Second Contract: For Ex-works (India) supply of plant and equipment including type test charges and mandatory spares.
- (iii) Third Contract: For providing all services i.e. port handling, port clearance and port charges for the imported goods, further loading, inland transportation for delivery at site, inland transit insurance, unloading, storage, handling at site, installation, insurance covers other than inland transit insurance, testing, commissioning and conducting Guarantee tests in respect to fall the equipment supplied under the 'First Contract' & the 'Second Contract'.

All the above Contracts will contain a cross-fall breach clause specifying that breach of one Contract will constitute breach of the other Contracts which will confer a right on the Employer to terminate the other Contracts also at the risk and the cost of the Contractor.

In the case of successful Foreign Bidder, the award shall be made as follows:

- (i) First Contract: For CIF (Indian port-of-entry) supply of plant and equipment (including type test charges) and mandatory spares to be supplied from abroad.
- (ii) Second Contract: For Ex-Works (India) Supply of all Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country.

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- (iii) Third Contract : For providing all services i.e. port handling, port clearance and port charges for the imported goods, further loading, inland transportation for delivery at site, inland transit insurance, unloading, storage, handling at site, installation, insurance covers other than inland transit insurance, testing, commissioning and conducting Guarantee tests in respect of all the equipment supplied under the First Contract & the Second Contract and all other services as specified in the Contract Documents.

All the above Contracts will contain a cross-fall breach clause specifying that breach of one Contract will constitute breach of the other Contracts which will confer a right on the Employer to terminate the other Contracts also at the risk and the cost of the Contractor.

The foreign bidder, however, has the option, to be exercised as a part of its bid proposal, to propose an Assignee in its bid to execute the Second Contract and / or the Third Contract. For the scope of work envisaged by the foreign bidder, in its bid, to be executed by Assignee, the Assignee should have relevant / required capacity and experience of executing similar job. The bidder shall substantiate with relevant / required documents in the bid to establish capacity and experience of the Assignee.

If the foreign bidder has proposed an Assignee in its bid to execute the Second Contract and/or the Third Contract and has also furnished written unequivocal consent of the proposed Assignee to work as an independent Contractor on the terms and conditions offered by the bidder and if the Employer is satisfied with the capacity and experience of the Assignee proposed in the bid, the Employer will enter into the 'Second Contract' and / or the 'Third Contract' and or Fourth Contract with the Assignee. However, if the Employer in its judgement does not find acceptance of the Assignee proposed in the bid as its Contractor, then on the request of the Employer, the bidder shall have option to propose an alternate Assignee on the same terms and conditions and cost as offered in its bid. It is expressly understood and agreed that in case the option is not exercised by the Bidder or if the Assignee fails to enter into Contract(s) with the Employer or if the Employer in its judgement does not find acceptance of the Assignee as its Contractor, then the foreign bidder shall be obliged to enter into and execute all the three Contracts with the Employer covering the entire scope of work envisaged in the bidding documents on the same terms and conditions and cost as offered in its bid.

However, for the above purpose, only one Assignee shall be permitted for both Second Contract and / or Third Contract.

31. Employer's Right to Accept Any Bid and to Reject Any or All Bids

- 31.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to award of

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contract, without thereby incurring any liability to the affected Bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Employer's action.

32. Notification of Award

- 32.1 Prior to the expiration of the period of bid validity, the Employer will notify the successful Bidder in writing by registered letter or by email, that its bid has been accepted. The notification of award will constitute the formation of the contract.

33. Signing the Contract Agreement

On receipt of Employer's notification that its bid has been accepted, the successful Bidder/ Assignee of the successful foreign bidder (if applicable) shall prepare and finalize the Contract Documents for signing of the formal Contract Agreement and shall enter into the Contract Agreement with the Employer, as per Proforma enclosed with the Bidding Documents, on non-judicial stamp paper of appropriate value within 28 days from the date of the Notification of Award.

34. Performance Security

- 34.1 Within twenty-eight (28) days after receipt of the Notification of Award, the successful Bidder shall furnish performance securities for ten (10%) of Contract Price for all the contracts and in the form provided in the section "Forms and Procedures" of the bidding documents.
- 34.2 In case Deed(s) of Joint Undertaking by the Contractor along with his associate(s) / collaborator(s) form part of the Contract, then, unconditional Bank Guarantee(s) from such associate(s) / collaborator(s) for amount(s) specified in Bid Data Sheets shall be furnished within twenty-eight (28) days after Notification of Award. These Bank Guarantees shall be furnished in the form provided in the section "Forms and Procedures" of the bidding documents and shall be valid till such period as specified in the corresponding format for Deed of Joint Undertaking.
- 34.3 In case of a successful foreign bidder, if the Employer accepts to enter into the Second Contract and / or Third Contract and / or Fourth Contract with the Assignee, pursuant to ITB Sub-Clause 30.4 above, then, within twenty eight (28) days of Notification of Award, the Assignee shall furnish additional performance security(ies) for ten (10%) of the value of the Contract(s) entered into with the Assignee and in the form provided in the Section "Forms and Procedures" of the bidding documents.

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- 34.4 The Bank Guarantees submitted towards Performance Security shall be essentially from any of the Banks listed in Annexure-I to SCC.

The Bank Guarantee submitted from within India towards Performance Security shall be issued on Non-Judicial Stamp Paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG is executed whichever is higher.

In case of guarantees issued by branches outside India for foreign banks, the bank guarantees shall be routed through the correspondent Bank in India for due verification of signatures of the executant and lodgement of claim.

The BG issued by a Bank outside India also needs to bear Stamp Duty of appropriate value applicable to the place in NTPC where BG is to be submitted, the BG will be adjudicated from Collector of Stamps, within 3 months of arrival of BG in India and the expenses incurred in this regard shall be recovered from the Contractor.

- 34.5 While issuing the physical BG, the Bidder's Bank shall also send electronic message to Employer's Beneficiary Bank whose details are provided in Bid Data Sheets (BDS) through secure SFMS (in case of BGs issued from within India) or SWIFT (in case of BGs issued from outside India).

34.6 **Annulment of award**

Failure of the successful Bidder to comply with the requirements of ITB Clause 33 or Clause 34.0 shall constitute sufficient grounds for the annulment of the award and forfeiture of his bid security.

G. Other Instructions

35.0 **Ineligibility for participation in re-tender/ future tenders**

- i) Notwithstanding the provisions specified in ITB Sub-Clause 12.8 and ITB Clause 34.5, if a bidder after having been issued the Notification of Award, either does not sign the Contract Agreement pursuant to ITB Clause 33 or does not submit an acceptable Performance Security pursuant to ITB Clause 34.1 to 34.4, and which results in retendering of the package, then such bidder/contractor shall be treated ineligible for participation in re-tendering of this particular package. Further, such bidder/contractor shall also be dealt as per the provisions of policy for Debarment from Business Dealings.

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- ii) If a bidder after opening of tenders where EMD is 'NIL/Not applicable' or exempted for bidders as per policy guidelines, withdraws its offer within the validity period of the offer, then such bidder shall be treated as ineligible for participation in the future tenders for a period of 6 months from the date of withdrawal of the bid, and also in re-tendering of this particular package.
- iii) If a bidder after having been issued the Notification of Award/ Purchase Order of a package where EMD is 'NIL/Not applicable' or exempted for bidder as per policy guidelines, either does not sign the Contract Agreement pursuant to ITB Clause titled 'Signing the Contract Agreement' or does not submit an acceptable Performance Security pursuant to ITB Clause titled 'Performance Security', and which result in retendering of the package, then such bidder/contractor shall be treated ineligible for participation in re-tendering of this particular package. Further, such bidder/contractor shall also be dealt as per the provisions of the contract and policy for Debarment from Business Dealings.

36.0 Time Schedule (Programme of performance)

The plant and equipment covered by this bidding document are required to be shipped and installed, and the facilities are to be completed within the period named in the Bid Data Sheets after the effective date specified in the Contract Agreement. Bidders are required to base their prices on the time schedule given in relevant appendix to the form of Contract Agreement (Time Schedule) or, where no time schedule is given, on the completion date(s) given in the Bid Data Sheets. No credit will be given for earlier completion.

- 36.1 Notwithstanding above to the extent applicable, Employer has specified in the Bid Data Sheets the schedule for attainment of 'Completion of Trial Operation' & 'Completion of Facilities'. Employer has also specified the date of attainment of major project milestones in the Bid Data Sheets.

Based on the aforesaid completion schedule, Bidder shall furnish along with their Envelope-I (Techno-Commercial) bid, a detailed work schedule in line with major project milestones specified in the Bid Data Sheets as Attachment-14. The work Schedule shall include at least following activities for each system / major equipment showing their inter-relationships between engineering, supply and site execution:

- i. Basic Engineering
- ii. Ordering on sub-vendor (wherever applicable)
- iii. Detailed Engineering
- iv. Raw material procurement, fabrication/ manufacturing

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- v. Testing, Inspection and commencement of sequential dispatch
- vi. Transportation and receipt at site.
- vii. Completion of dispatch
- viii. Release of civil foundations/ fronts for equipment erection
- ix. Completion / achievement of milestones considered for progressive payment (as per bid documents)
- x. Trestle / Gallery readiness
- xi. Progressive readiness of various buildings
- xii. Start of erection (area-wise)
- xiii. Intermediate milestones and completion of erection
- xiv. Commissioning of the system

37.0 **Corrupt or Fraudulent Practices**

37.1 Employer requires that Bidders, Contractors and Suppliers observe the highest standard of ethics during the procurement and execution of the contracts. In pursuance of this policy, Employer:

(a) defines, for the purposes of this provision, the terms set forth below as follows:

- i) **“Corrupt practice”** means the offering, giving, receiving or soliciting money or of anything of value to influence the action of a public official in the procurement process or in contract execution or outcome of the bidding process;
- ii) **“Fraudulent practice”** means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition;
- iii) **“Anti-competitive practice”**: any collusion, bid rigging or anti-competitive arrangement, or any other practice coming under the purview of The Competition Act, 2002, between two or more bidders, with or without the knowledge of the Employer, that may impair the transparency, fairness and the progress of the procurement process or to establish bid prices at artificial, non-competitive levels;
- iv) **“Coercive practice”**: harming or threatening to harm, persons or their property to influence their participation in the procurement process or affect the award or execution of a contract;
- v) **“Obstructive practice”**: materially impede the Employer’s investigation into allegations of one or more of the above mentioned prohibited practices either by deliberately destroying, falsifying, altering; or by concealing of evidence material to the investigation; or by making false statements to investigators and/ or by threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or by impeding the Employer’s rights of audit or access to information.

(b) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in aforesaid practices in competing for the contract in question;

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- (c) will declare a firm ineligible, for a period of time as specified in the policy for Debarment from Business Dealings, to be awarded a contract if it at any time determines that the firm has engaged in aforesaid practices in competing for or in executing a contract of the Employer.

37.2 Furthermore, Bidders shall be aware of the provision stated in GCC Sub-Clause 42.2.

38.0 **Fraud Prevention Policy**

The Bidder along with its associate/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to the Fraud Prevention Policy of Employer displayed on its tender website <https://ntpctender.ntpc.co.in/> or www.nvvn.co.in and shall immediately apprise Employer about any fraud or suspected fraud as soon as it comes to their notice. If in terms of above policy it is established that the bidder/his representatives have committed any fraud while competing for this contract then the bid security of the bidder shall be forfeited.

Bidders shall certify their compliance on “**Fraud Prevention Policy**” of Employer by accepting the following GTE at the e-Tender Portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of General Technical Evaluation (GTE) of the Tender at e-Tender Portal shall be considered as bidder's confirmation that they have read the contents of the Fraud Prevention Policy as displayed on tender website at <https://ntpctender.ntpc.co.in/> or www.nvvn.co.in under section ‘policy docs’ and undertake that they along with their associate/collaborator/ subcontractors / sub vendors / consultants / service providers shall strictly abide by the provisions of the Fraud Prevention Policy.

39.0 **Pre-Bid Conference**

The Bidder or his authorised representative (s) is invited to attend the pre-bid conference which will take place as per details stipulated in Bid Data Sheets. Bidders are advised to visit and examine the site during the pre-bid conference, regardless of their visit to site earlier.

The purpose of the conference will be to clarify any issue regarding the Bidding Documents subsequent to Site visit by Bidder.

The Bidder is requested to submit questions in writing at the e-Tender Portal or by email before and/or after the pre-bid conference to reach the Employer at the address indicated in BDS, not later than the date as specified at the e-Tender Portal. Employer's responses to the queries raised by the bidders shall be in the form of Clarification to the bidding documents, which will be uploaded / posted on the e-tender portal.

Any queries submitted by Bidder after the specified last date shall not be responded to by Employer and the Bidder will be required to submit their bid based on the Bidding documents read in conjunction with Amendments/Clarifications/Errata thereof.

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Any modifications of the Bidding Documents which may become necessary as a result of the pre-bid conference shall be made by the Employer exclusively through an amendment to the bidding documents.

Non-attendance at the pre-bid conference will not be a case for disqualification of a bidder. However, Bidder is expected to visit and examine the site to acquaint itself with the ground situations and attend the pre-bid conference subsequently.

40.0 Integrity Pact

Bidders are required to unconditionally accept all the conditions of the "Integrity Pact (IP)" as per **Attachment-17** to the Bidding Documents which has been pre-signed by the Employer.

Bidders shall certify their compliance on "**Integrity Pact** " by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender Portal:

“Do you certify full compliance to all provisions of Bidding Document?”

On Bidder’s acceptance to the above GTE condition, Bidder confirms to have read, understood and unconditionally accept & commit to all the contents, terms, conditions and undertakings mentioned in the Integrity Pact which has been pre-signed by the Employer and enclosed with the Bidding Documents. Where the Joint Venture(s) / Consortium are permitted to participate in the bid pursuant to ITB Clause 8.1.2(a), acceptance of above GTE by bidder shall mean that all the JV Partner(s)/ Consortium members have read, understood and unconditionally accept & commit to all the contents, terms, conditions and undertakings mentioned in the Integrity Pact which has been pre-signed by the Employer and enclosed with the Bidding Documents.

On Acceptance of the above GTE, Integrity Pact shall be considered signed by the Bidder / JV Partner(s)/ Consortium members and the same shall come into force from the date of submission of bid.

It may also be noted that subsequent to Employer’s evaluation of Bids, resulting into award of Contract to a particular Bidder, the Integrity Pact so submitted shall form an integral part of the Contract.

42.0 Independent External Monitors (IEMs)

In respect of this package, the Independent External Monitors (IEMs) would be monitoring the bidding process and execution of contract to oversee implementation and effectiveness of the Integrity Pact Program.

The Independent External Monitor(s) (IEMs) as mentioned at NVVN website (<https://nvvn.co.in/>) under Integrity Pact tab have been appointed by NVVN, in terms of Integrity Pact (IP) which forms parts of the NVVN Tenders/Contracts.

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This panel is authorized to examine /consider all references made to it under this tender. The bidder(s), in case of any dispute(s) / complaint(s) pertaining to this package may raise the issue with the designated 'Nodal Officer' in NVVN.

The Independent External Monitors (IEMs) have the right to access without restriction all Project documentations of the Employer including that provided by the Contractor. The Contractor will also grant the IEMs, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his Project Documentations. The same is applicable to Subcontractors. The IEMs are under contractual obligation to treat the information and documents of the Bidder / Contractor / Sub-Contractors/ JV partners/Consortium member with confidentiality.

The Nodal Officer for necessary coordination with Independent External Monitors shall be

Concerned Group Head: in C&M	:	if the issue pertains to awarding of Contract by C&M
Concerned Head of Department	:	if the issue pertains to other departments
Concerned Head of Department	of :	if the issue pertains to post- award execution of Contract

42.0 Deleted

43.0 Policy for Debarment from Business Dealings

The Employer has in place a Policy for Debarment from Business dealings displayed on the website www.ntpc.co.in / www.ntpctender.ntpc.co.in. The version of Policy presently applicable is **mentioned in BDS**. Bidder/Contractor may be debarred from Business dealings on account of any of the grounds and following the procedures as detailed in the said Policy for Debarment from Business Dealings.

Bidders shall certify their compliance on "Policy for Debarment from Business Dealings " of Employer by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender Portal <https://eprocurmentpc.nic.in/>:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of above GTE shall be considered as bidder's confirmation to the following conditions:

- (1) Bidder have read the contents of Debarment Policy (applicable version mentioned in BDS) displayed on the website www.ntpc.co.in / www.ntpctender.ntpc.co.in and agreed to abide by this policy.
 - a) Bidder is not Banned/Blacklisted by Ministry of Power or Deptt. of Expenditure, Ministry of Finance as on date of submission of bid.

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- b) Bidder have not employed any public servant dismissed/removed or person convicted for an offence involving corruption or abetment of such offences.
 - c) Bidder's Director(s)/ Owner(s)/ Proprietor/ Partner(s) have not been convicted by any court of law for offences involving corrupt and fraudulent practices including moral turpitude in relation to business dealings with Government of India or NTPC or NTPC's group companies during the last five years.
- (2) Bidder further confirms as under:

that if at any point subsequent to award of Contract, the declarations given above are found to be incorrect, NVVN/ Employer shall have the full right to terminate the Contract and take any action as per applicable laws for breach of contract including forfeiture of Bid Security/Performance Bank Guarantee.

44.0 **Royalty**

The Bid Price shall be inclusive of any Royalties and/or Seigniorage Fee and/or Cess and/or other charges payable on the quarried or mined metal, minerals, or minor minerals, as the case may be, at the rate(s) prevailing as on seven (7) days prior to the date of Techno-commercial bid opening.

45.0 **“Restrictions on procurement from a Bidder of a country which shares a land border with India”**

- 45.1 Any Bidder (including its Collaborator/Associate/DJU Partner/JV partner/Consortium Member/Assignee, wherever applicable) from a country which shares a land border with India will be eligible to bid in this tender only if bidder is registered with the Competent Authority as mentioned in Special Conditions of Contract (SCC).

Further, any bidder having specified Transfer of Technology (ToT) arrangement with an entity from a country which shares a land border with India, will be eligible to bid only if the bidder is registered with the competent authority as mentioned in Special Conditions of Contract (SCC).

(Definition/Requirement of ToT shall be as specified in DOE OM Ref. No. F.7/10/2021-PPD(1) dated 23.02.2023, enclosed with SCC)

Such registration should be valid for the entire period of bid validity or any extension thereof. However, in case the validity period of registration is less than bid validity period, the Bidder shall be required to submit the extension of the validity period of registration before the opening of price bids, failing which the bid shall be rejected.

Further the successful bidder shall not be allowed to sub-contract services/works to any “Sub-contractor” from a country which shares a land border with India unless such Sub-contractor is registered with the competent Authority as mentioned in SCC.

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INSTRUCTIONS TO BIDDERS (ITB)

However, the said requirement of registration will not apply to bidders/sub-contractors from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects. Bidders may apprise themselves of the updated lists of such countries available in the website of the Ministry of External Affairs.

- 45.2 “Bidder” (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency, branch or office controlled by such person, participating in a procurement process.
- 45.3 “Sub-contractor” (including the term ‘Sub-vendor’/Sub-supplier’ in certain contexts) means any person or firm or company, every artificial juridical person not falling in any of the descriptions of Sub-contractors stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.
- 45.4 “Bidders from a country which shares a land border with India” / “Sub-contractor from a country which shares a land border with India” / “Entity from a country which shares a land border with India” mentioned in para 46.1 mentioned above means;
- a) An entity incorporated, established or registered in such a country; or
 - b) A subsidiary of an entity incorporated, established or registered in such a country; or
 - c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
 - d) An entity whose beneficial owner is situated in such a country; or
 - e) An Indian (or other) agent of such an entity; or
 - f) A natural person who is a citizen of such a country; or
 - g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.
- 45.5 The beneficial owner for the purpose of clause “46.4” above will be as under;
- a) In case of company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

Explanation-

- i. “Controlling ownership interest” means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company;
- ii. “Control” shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholdings or management rights or shareholders agreements or voting agreements;

- b) In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more judicial person, has

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INSTRUCTIONS TO BIDDERS (ITB)

ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

c) In case of an unincorporated associations or body of individuals, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

d) Where no natural person is identified under (a) or (b) or (c) above, the beneficial owner is the relevant natural person who holds the position of senior managing officials;

e) In case of a trust, the identifications of beneficial owner(s) shall include identification of the author of trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

45.6 An Agent for the purpose of clause “46.4” is a person employed to do any act for another, or to represent another in dealings with third person.

[Note: i. A person who procures and supplies finished goods from an entity from a country which shares a land border with India will, regardless of the nature of his legal or commercial relationship with the producer of the goods, be deemed to be an Agent.

ii. However, a bidder who only procures raw material, components etc. from an entity from a country which shares a land border with India and then manufactures or converts them into other goods will not be treated as an Agent.]

45.7 Bidders shall certify their compliance to ITB Clause “Restrictions on procurement from a Bidder of a country which shares a land border with India” by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender Portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of above attribute shall be considered as Bidder's confirmation that Bidder has read and understood the ITB Clause regarding “Restrictions on procurement from a Bidder of a country which shares a land border with India” and its bid is in compliance to this clause.

In case it is established that Bidder has provided any false information in pursuance of the aforesaid ITB Clause, while competing for this contract, then its bid shall be rejected and bid security shall be forfeited.

In case of a successful bidder, if it is established that the Bidder has not complied with terms of aforesaid ITB Clause, during execution of contract, this would be considered as fraudulent practices as mentioned in 5.1 (j) of “Policy for Debarment from Business Dealings” and shall be dealt accordingly.

46.0 **ABAC (Anti-Bribery and Anti-Corruption) Policy**

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INSTRUCTIONS TO BIDDERS (ITB)

The Bidder and its employees along with its Associate/ Collaborator/ Sub-Contractors / Sub-Vendors / Consultants / Service Providers and all other persons associated with business of Employer shall strictly adhere to Anti-Bribery and Anti-Corruption (ABAC) Policy of Employer displayed on tender website <https://ntpctender.ntpc.co.in/>.

Bidders shall certify their compliance on “Anti-Bribery and Anti-Corruption (ABAC) Policy” of Employer by accepting the following GTE at the e-Tender Portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of General Technical Evaluation (GTE) of the Tender at e-Tender Portal shall be considered as bidder's confirmation that they and their employees along with their associate / collaborator/ subcontractors / sub vendors / consultants / service providers shall strictly abide by “Anti-Bribery and Anti-Corruption (ABAC) Policy” of Employer as displayed on tender website at <https://ntpctender.ntpc.co.in/> under section ‘policy docs’ and undertake that they represent and confirm that they are aware of, understand, and will comply with all applicable laws and regulations relating to anti- corruption and anti-bribery and the ABAC Policy of Employer.

47.0 CONFLICT OF INTEREST

47.1 A bidder shall not have conflict of interest with other bidders. Such conflict of interest can lead to anti-competitive practices to the detriment of Employer’s interests. A bidder may be considered to have a conflict of interest with one or more parties in the bidding process, if:

- a) they directly or indirectly control, are controlled by or are under common control of another entity; or
- b) they have the same legal representative/agent for purposes of their bids; or
- c) they have relationship with each other, directly or through common third party(ies), that puts them in a position to have access to information about or influence on the bid of another Bidder; or
- d) Bidder and/or any of its allied entity(ies), which directly or indirectly control(s) or is(are) controlled by or is(are) under common control of another entity has(ve) participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the tender; or
- e) Bidder participates in more than one bid in this bidding process.

For the purposes of this clause the term ‘control’ shall have the following meaning:

“control” shall include the right to appoint majority of the directors or to control the management or policy decisions exercisable by a person or persons acting individually or in concert, directly or indirectly, including by virtue of their shareholding or management rights or shareholders’ agreements or voting agreements or in any other manner.

Note: If two or more CPSEs/State PSEs participate in a tender, they will not be deemed to fall under the 'Conflict of Interest' provisions solely because they are under common control of Government of India/State Government.

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INSTRUCTIONS TO BIDDERS (ITB)

- 47.2 Bidders shall certify their compliance to ITB Clause “Conflict of Interest” by accepting the following General Technical Evaluation (GTE) of the Tender at e-Tender Portal:

“Do you certify full compliance to all provisions of Bidding Document?”

Acceptance of above GTE shall be considered as Bidder's confirmation that Bidder has read and understood the ITB Clause regarding “Conflict of Interest” and its bid is in compliance to this clause.

In case it is established that Bidder has provided any false information in pursuance of the aforesaid ITB Clause, while competing for this contract, then its bid shall be rejected and bid security shall be forfeited.

In case of a successful bidder, if it is established that the Bidder has not complied with terms of aforesaid ITB Clause, during execution of contract, this would be considered as fraudulent practices as mentioned in para 5.1 (j) of “Policy for Debarment from Business Dealings” and shall be dealt accordingly.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)	BIDDING DOCUMENT NO. NVVN / C&M/ RE-333 /2023-24 SECTION - II (ITB)	PAGE 45 OF 45
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SECTION – III

BID DATA SHEET (BDS)

FOR ANDAMAN & NICOBAR GAS POWER

PROJECT (50 MW)

AT

**HOPE TOWN, SRI VIJAYA PURAM,
ANDAMAN AND NICOBAR**

IFB DOCUMENT NO.: NVVN / C&M / RE-333 / 2024-25

BDS Item No.	ITB Clause Ref., if any	DATA
<p>SECTION - III</p> <p>BID DATA SHEET (BDS)</p> <p>NAME OF PACKAGE: ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)</p> <p>The following bid specific data for the Plant & Equipment to be procured, shall amend and/or supplement the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in the ITB.</p>		
1.0	ITB 1.1	<p>A. INTRODUCTION</p> <p>Instructions Related to E-Tendering:</p> <p>Bidder are required to go through the Guidelines provided at following e-tendering site:</p> <p>https://eprocurmentpc.nic.in</p> <p>Name of the Package: ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW).</p>
2.0	ITB 5.1	<p>B. THE BIDDING DOCUMENTS</p> <p>Name and address of Employer:</p> <p>GM(C&M)/ Sr. Manager (C&M), NTPC Vidyut Vyapar Nigam Limited, 5th Floor, Engineering Office Complex, A-8A, Sector-24, Noida-201301 Distt. Gautam Budh Nagar State of U. P. INDIA Telephone No. (+91) - (11) - 24387080</p> <p>Email: kushankumar@ntpc.co.in/ nvvncontracts@ntpc.co.in</p>

BDS Item No.	ITB Clause Ref., if any	DATA
<p>3.0</p> <p>3.1</p> <p>3.2</p> <p>4.0</p> <p>4.1</p> <p>4.2.1</p>	<p>ITB 8.1.2 (a)</p>	<p>C. PREPARATION OF BIDS</p> <p>Qualification Requirements</p> <p>In addition to the requirements stipulated under section Instructions to Bidder (ITB), the Bidder should also meet the qualifying requirements stipulated hereunder in IFB clauses 6.1.0 or 6.2.0 or 6.3.0 as the case may be and the IFB clause 6.4.0 along with the notes.</p> <p>Bids not meeting the requirements as stated above shall be rejected.</p> <p>Whether JVs are permitted : No</p> <p>Whether Associate/Collaborator permitted : Yes</p> <p>Wherever the bidder is seeking qualification on the strength of his Associate(s)/Collaborator(s), then in addition to filling his own details as per Attachment-3 of Section-VII, Part-1 of 3, bidder shall ensure that details as per Attachments 3(B) to 3(H) and 3(J) of Section-VII, Part 1 of 3 is filled-in for such Associate(s)/Collaborator(s) separately along with supporting documents to enable Employer to carry out Capability and Capacity assessment (including Financial Capability) as stated in ITB Clause 8.1.2(a), if required by the Employer</p> <p>The reference plants whose details have been declared as per the specified format in the relevant attachment [i.e. Attachment No.-3A] shall only be considered to ascertain the bidder's compliance to the specified Qualifying Requirement (QR). Bidders wishing to provide additional reference plants are required to declare the same in similar format which shall be additionally attached. However, bidders are not permitted to quote more than three (03) times of the reference works/plants wherever specified in the Qualifying Requirements for this purpose.</p> <p>Bidders are required to furnish the details of past experience based on which selection is to be made as per format enclosed in the bidding documents and enclose relevant documents like copies of authentic work order, completion</p>

BDS Item No.	ITB Clause Ref., if any	DATA
4.2.2		<p>certificate, agreements etc. supporting the details/data provided in the format. No claims without supporting documents shall be accepted in this regard. However, if any of the reference work pertains to the Contract(s)/Works executed by Bidder for NVVN/NTPC in the past then in respect of such Contract(s)/Works Bidder shall not be required to enclose Client Certificate(s) along with its bid.</p> <p>The Employer at its discretion may seek any clarification and/or documentary evidence only for the reference plants as mentioned above. However, no change or substitution of the reference plants as new/additional plant for conforming to the specified Qualifying Requirement shall be sought, offered or permitted.</p> <p>All the bidders shall submit all the documents, in support of Technical Qualification Requirements (such as copy of Purchase Orders/ Work Orders/ Contract Agreements/ Client Certificates etc.), duly certified and verified for authenticity from Independent Statutory Auditor of their Company or specified Third-Party Inspection Agency (TPIA).</p> <p>Further, wherever information can be drawn from books of accounts, records and other relevant documents, Bidders can also submit a certificate issued by their Independent Statutory Auditor certifying the data required for meeting the Technical Qualification Requirements.</p> <p>Such bidder shall be required to submit duly certified and verified documents from their Statutory Auditors or specified TPIA in support of meeting Technical QR along with a certificate regarding verification of authenticity of documents as per the format placed at Appendix-B to Attachment-3A (Undertaking from Statutory Auditor) and/ or Appendix-C to Attachment-3A (Undertaking from TPIA) of Book 1 of 3, Sec-VII. All the documents submitted by the bidder in support of meeting Technical QR shall be digitally signed by the Statutory Auditor and/ or specified TPIA.</p>
4.2.3		<p>In case documents are certified & verified for authenticity through TPIA, the verification and certification of authenticity of documents is acceptable from any of the TPIAs as mentioned at NTPC tender website (https://ntpctnder.ntpc.co.in) under “policy for document Authentication Process in Tenders of NTPC Ltd” tab. However, Bidders must verify the accreditation validity of the designated TPIA before proceeding to engage</p>

BDS Item No.	ITB Clause Ref., if any	DATA
4.2.4		<p>them for document certification.</p> <p>The following website may be referred for contact details and accreditation validity of above mentioned TPIAs:</p> <p>http://nabcb.qci.org.in/inspection-body/</p> <p>Any document pertaining to reference works/ plants in support of Technical QR, which is not certified by specified TPIA or Statutory Auditor of the bidder, as per the format enclosed with the bidding documents, shall not be considered verified/ certified for the purpose of evaluation, and the bid shall be liable for rejection.</p> <p>The Bidder shall be responsible for getting their documents/ credentials in support of Qualifying Requirements verified & certified by their Statutory Auditor(s) and/ or specified TPIAs. All the costs pertaining to third party verification and certification (including those by statutory auditors) shall be borne by the Bidder. Employer shall have no liability (financial or otherwise) towards the same and shall not be liable for any claim/ dispute between the bidder and TPIA and/ or Statutory Auditor.</p>
5.0	ITB 12	<p>BID SECURITY</p>
5.1	ITB 12.1	<p>Amount of Bid Security: Bid Security shall be submitted in an amount of INR 10,00,00,000 (Indian Rupees Ten Crores only) or USD 1,171,800 (One Million One Hundred Seventy-One Thousand Eight Hundred US Dollars)</p>
5.2	ITB 12.2	<p>List of the Banks are specified at Annexure-I to BDS.</p> <p>D. SUBMISSION OF BIDS</p>
6.0	ITB 15.1, 15.2	<p>Any clarification sought on the bidding documents, the bidder's bid, any modification or withdrawal of bids shall be addressed to the Employer. However, they are required to be submitted as per address given below:</p> <p>GM (C&M)/ Sr. Manager (C&M) NTPC Vidyut Vyapar Limited, 5th Floor, Engineering Office Complex, A-8A, Sector-24, Noida-201301 Email: nvncontracts@ntpc.co.in</p>

BDS Item No.	ITB Clause Ref., if any	DATA
6.1	ITB 15.1,12.1	Bids shall be submitted online. Only Bid Security, Tender Fee, Notarized Power of Attorney, & Letter of Undertaking / Deed of Joint Undertaking / Letter of Support (as applicable) are to be submitted in original (hard copy) at address specified above.
6.2	ITB 16.1	Deadline for Bid Submission- as indicated in GepNIC Portal and subsequent amendment, if any.
7.0	ITB 19.1	<p>E. BID OPENING AND EVALUATION</p> <p>Location of Bid Opening:- NTPC Vidyut Vyapar Limited, 5th Floor, Engineering Office Complex, A-8A, Sector-24, Noida-201301 Email: nvncontracts@ntpc.co.in</p> <p>Date and Time for Techno-Commercial Bid Opening:</p> <p>Please refer e-Tender Portal.</p> <p>Date and Time of Opening of Price Bid: Shall be intimated separately by the Employer</p>
7.1	ITB 19.2.4	Whether Reverse Auction applicable : No
8.0	ITB 26.3 & ITB 27.1	<p>Currency chosen for: Indian Rupees purpose of evaluation</p> <p>Type of Transaction &: Bill Selling Exchange Rate established source of Exchange by State Bank of India Rate</p> <p>Date of Exchange Rate Date of opening of Envelope-I (Techno-commercial) Bid</p>
9.0	ITB 36.0	Completion of Facilities for all the modules shall be attained within 28 months from the date of Notification of Award.
9.1 1.0	This work schedule	is made for Andaman & Nicobar Gas Power Project 50 (±10) MW with 4 to 11 nos. of LNG based engines, Generator with

BDS Item No.	ITB Clause Ref., if any	DATA																																														
		<p>excitation system, NOx Control system (if required), Engine Lube oil system, Engine cooling water system, Compressed Air System, Pipings, Air conditioning & Ventilation system, Fire detection & protection system, Roof Top PV Solar, complete Control & Instrumentation and Electrical systems etc. for the project as per scope of work.</p> <p>Suggestive Milestones Schedule:</p> <table border="1"> <thead> <tr> <th rowspan="2">Sl.</th> <th rowspan="2">Description of Area/ Major Milestones</th> <th colspan="2">Duration in months from NOA</th> </tr> <tr> <th>Start</th> <th>Finish</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Basic Engineering</td> <td>00</td> <td>04</td> </tr> <tr> <td>2.</td> <td>Detailed Engineering</td> <td>-</td> <td>09</td> </tr> <tr> <td>3.</td> <td>Completion of Ordering of BOIs (Bought out Items)</td> <td>-</td> <td>06</td> </tr> <tr> <td>4.</td> <td>Commencement of Manufacturing</td> <td>05</td> <td>-</td> </tr> <tr> <td>5.</td> <td>Supply of Materials</td> <td>08</td> <td>20</td> </tr> <tr> <td>6.</td> <td>Establishment of Site Office, Storage Facilities & Mobilisation</td> <td>-</td> <td>06</td> </tr> <tr> <td>7.</td> <td>Equipment Erection Works* (Mechanical, Electrical, C&I)</td> <td>09</td> <td>24</td> </tr> <tr> <td>8.</td> <td>Progressive Commissioning of Gas Engine Modules</td> <td>24</td> <td>26</td> </tr> <tr> <td>9.</td> <td>Completion of Facilities</td> <td>-</td> <td>28</td> </tr> <tr> <td>10.</td> <td>Supply of Mandatory Spares</td> <td>-</td> <td>22</td> </tr> </tbody> </table> <p>* Civil front shall be handed over progressively by the owner and schedule for same shall be finalised at the time of L2 schedule finalisation</p> <p>Note:</p> <ul style="list-style-type: none"> The term "Supply" denotes receipt of material at site. For scheduling purpose receipt at site shall be taken as up to 2 weeks for inland supply and up to 4 weeks for Offshore supplies from dispatch. <p>The prospective bidders have to ensure timely and suitable mobilization at site. The bidder must submit a detailed work schedule in their bid capturing the area wise progressive completion of works and also deployment plan (timelines) for major T&Ps for works under the scope of contract. The same shall be discussed during finalization of L2 schedule. However, contractor will have to ensure the deployment of T&Ps as per the actual requirement at site to meet the project milestones.</p>	Sl.	Description of Area/ Major Milestones	Duration in months from NOA		Start	Finish	1.	Basic Engineering	00	04	2.	Detailed Engineering	-	09	3.	Completion of Ordering of BOIs (Bought out Items)	-	06	4.	Commencement of Manufacturing	05	-	5.	Supply of Materials	08	20	6.	Establishment of Site Office, Storage Facilities & Mobilisation	-	06	7.	Equipment Erection Works* (Mechanical, Electrical, C&I)	09	24	8.	Progressive Commissioning of Gas Engine Modules	24	26	9.	Completion of Facilities	-	28	10.	Supply of Mandatory Spares	-	22
Sl.	Description of Area/ Major Milestones	Duration in months from NOA																																														
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BDS Item No.	ITB Clause Ref., if any	DATA
9.2		<p>The bidder shall also be required to submit a brief integrated PERT Network (L1 Schedule) matching with the above work schedule. The L1 Schedule shall, interalia, include at least following activities for each system listed above, showing their inter-relationship and duration so as to meet the above-mentioned milestone details.</p> <p>(i) Milestones to be incorporated in L1 Network to be submitted with bid:</p> <ol style="list-style-type: none"> 1. Ordering on sub vendor (wherever applicable) 2. Start of engineering 3. Completion of engineering 4. Start of manufacturing/fabrication 5. Completion of manufacturing/fabrication 6. Readiness and completion of Type Test 7. Commencement of Supplies 8. Completion of supplies of all items 9. Completion of site delivery of mandatory spares. 10. Commencement of Civil / Structural Works (if applicable) 11. Completion of Civil / Structural Works (if applicable) 12. Start of Erection 13. Completion of Erection 14. Testing and commissioning of the System 15. Completion of the Facilities
9.3		<p>The master network and the key milestone dates will be discussed with the successful bidder and agreed upon before the issue of Notification of Award. Engineering Drawing and Data Submission Schedule shall also be discussed and finalized before the issue of Notification of Award.</p>
9.4		<p>After the Notification of Award, the contractor shall plan the sequence of work of manufacture, supply and erection to meet the above stated dates of successful completion of facilities</p>

BDS Item No.	ITB Clause Ref., if any	DATA												
<p>9.5</p> <p>10.0</p>	ITB 27.5	<p>and shall ensure all work, manufacture, shop testing, inspection and shipment of the equipment in accordance with the required construction/erection sequence.</p> <p>Bidders are required to provide the list of required / necessary plant / equipment / machinery as per their proven practice in the bid and to ensure completion of the project in time.</p> <p>Bid evaluation factor:</p> <p>The guaranteed parameters as quoted by the bidder shall be considered for the purpose of Evaluation. The parameters and respective values of Efficiency/Performance adjustments for the purpose of calculation of efficiency/Performance adjustments for the bid evaluation shall be as stipulated below:</p> <table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Guarantee</th> <th>Rate of Bid Evaluation (BEF)</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>Net Heat Rate</td> <td></td> </tr> <tr> <td></td> <td>Net Heat Rate at 100% of Engine Load</td> <td>298605 (INR/(Kcal/Kwh)/MW) X ΔHR_{gb} X (Y/1000)</td> </tr> <tr> <td>ii)</td> <td>Net Output</td> <td>Separate BEF for Output is not applicable since cost per MW is considered for evaluation and comparison purpose. Bids with plants net output less than 45 MW shall not be considered for evaluation and shall be rejected. Any net output above 55MW shall not be taken into consideration for evaluation.</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• ΔHR_{gb} is the difference in net heat rate if the engine at 100% load quoted by the bidder from base value, in Kcal/Kwh, the base value being a best guaranteed heat rate amongst all bidders. <li>• Y is Guaranteed net power output of each engine quoted by bidder in Kw at 100% load. The net output shall be restricted by upper limit of range prescribed for the plant. 	Sl. No.	Guarantee	Rate of Bid Evaluation (BEF)	(i)	Net Heat Rate			Net Heat Rate at 100% of Engine Load	298605 (INR/(Kcal/Kwh)/MW) X ΔHR_{gb} X (Y/1000)	ii)	Net Output	Separate BEF for Output is not applicable since cost per MW is considered for evaluation and comparison purpose. Bids with plants net output less than 45 MW shall not be considered for evaluation and shall be rejected. Any net output above 55MW shall not be taken into consideration for evaluation.
Sl. No.	Guarantee	Rate of Bid Evaluation (BEF)												
(i)	Net Heat Rate													
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BDS Item No.	ITB Clause Ref., if any	DATA
11.0	ITB Clause 27.2 27.3, 27.5	<p>The best of the parameters for Net Heat Rate quoted by any Bidder shall be taken as the base and the differential between this and those quoted by other Bidders, multiplied by the adjustment factor for bid evaluation and the no. of units shall be used to arrive at the differential prices to be applied for the bid evaluation.</p>
12.0	General	<p>Functional Guarantees of the facilities</p> <p>The word "Functional Guarantee" wherever appearing in bidding documents shall be read in conjunction with Technical Specification, Section-VI of Bidding Documents.</p>
13.0	ITB 10.3	<p>Throughout the Bidding Documents (including amendment) Ex-works (India) shall mean EXW (India).</p> <p>Bidder to quote take out price for "Insurance to be taken by the Contractor" in Schedule 9. While Quoting Take Out Price Bidder should consider all the insurance prices covered in Schedule 3 and 4.</p> <p>The option of taking the insurance by NVVN, shall be exercised at the time of award of Contract. Further all the necessary details for insurance shall be furnished by the bidder to NVVN whenever required.</p>
14.0	ITB 44.0	<p>The version of Policy for Debarment from Business dealings presently applicable is Rev.04 (<i>Presently Rev.04 version of Policy is in use. However, Package Coordinator to check and specify the version available at website www.ntpc.co.in / ntpctender.ntpc.co.in</i>).</p>
15.0	ITB clause 28	<p>Methodology regarding Purchase Preference is specified in Annexure-II to BDS as per DPIIT circular dated 04.06.2020 regarding "Make in India" and its subsequent amendments.</p>

ANNEXURE – I

**LIST OF BANKS ACCEPTABLE FOR SUBMISSION
OF BANK GUARANTEE FOR BID SECURITY**

SCHEDULED COMMERCIAL BANKS

A. STATE BANK OF INDIA

B. NATIONALISED BANKS

- 1 Bank of Baroda
- 2 Bank of India
- 3 Bank of Maharashtra
- 4 Canara Bank
- 5 Central Bank of India
- 6 Indian Overseas Bank
- 7 Indian Bank
- 8 Punjab National Bank
- 9 Union Bank of India
- 10 Punjab & Sind Bank
- 11 UCO Bank

C. SCHEDULED PRIVATE BANKS (INDIAN BANKS)

- 1 Axis Bank Ltd
- 2 Bandhan Bank Limited
- 3 CSB Bank
- 4 City Union Bank
- 5 DCB Bank Ltd
- 6 Dhanlaxmi Bank Ltd
- 7 Federal Bank Ltd
- 8 HDFC Bank Ltd
- 9 ICICI Bank Ltd
- 10 IndusInd Bank Ltd
- 11 IDFC FIRST Bank Limited
- 12 Jammu & Kashmir Bank Ltd
- 13 Karnataka Bank Ltd
- 14 Karur Vysya Bank Ltd
- 15 Kotak Mahindra Bank
- 16 Lakshmi Vilas Bank Ltd
- 17 Nainital Bank Ltd
- 18 RBL Bank Limited
- 19 South Indian Bank Ltd
- 20 Tamilnad Mercantile Bank Ltd
- 21 Yes Bank Ltd
- 22 IDBI Bank Ltd.

D. SCHEDULED PRIVATE BANKS (FOREIGN BANKS)

- 1 AB Bank Ltd
- 2 Abu Dhabi Commercial Bank PJSC
- 3 American Express Banking Corporation
- 4 Australia & Newzealand Banking Group Limited
- 5 Barclays Bank Plc
- 6 Bank of America
- 7 Bank of Bahrain & Kuwait B.S.C.
- 8 Bank of Ceylon
- 9 Bank of China Limited
- 10 Bank of Nova Scotia
- 11 BNP Paribas
- 12 Citi Bank NA
- 13 Cooperatieve Rabobank UA
- 14 Crédit Agricole Corporate and Investment Bank
- 15 Credit Suisse AG
- 16 CTBC Bank Co Ltd
- 17 DBS Bank India Ltd
- 18 Deutsche Bank A.G.
- 19 Doha Bank Q.P.S.C
- 20 Emirates NBD Bank (PJSC)
- 21 First Abu Dhabi Bank PJSC
- 22 FirstRand Bank Ltd
- 23 HSBC Ltd
- 24 Industrial & Commercial Bank of China Ltd
- 25 Industrial Bank of Korea
- 26 JP Morgan Chase Bank, National Association
- 27 JSC VTB Bank
- 28 KEB Hana Bank
- 29 Kookmin Bank
- 30 Krung Thai Bank Public Company Ltd
- 31 Mashreq Bank PSC
- 32 Mizuho Bank Ltd
- 33 MUFG Bank, Ltd
- 34 NatWest Markets Plc
- 35 PT Bank Maybank Indonesia TBK
- 36 Qatar National Bank (Q.P.S.C.)
- 37 Sberbank
- 38 SBM Bank (India) Ltd
- 39 Shinhan Bank
- 40 Societe Generale
- 41 Sonali Bank Ltd
- 42 Standard Chartered Bank
- 43 Sumitomo Mitsui Banking Corporation
- 44 United Overseas Bank Ltd

45 Westpac Banking Corporation
46 Woori Bank

Note - Any Addition/ Deletion/ Modification in Bank list shall be as per changes in Second Schedule List by RBI from time to time.

*** Bidder to take note of NTPC letter ref. NTPC/FC/CS/BG/01 dated 03.09.2014 and SBI letter ref. CAG-I/AMT-1/2014-15/370 dated 04.09.2014 attached herewith this Annexure-I to BDS.**

ANNEXURE - II

PREFERENCE TO MAKE IN INDIA AND GRANTING OF PURCHASE PREFERENCE TO LOCAL SUPPLIERS

It is the policy of the Government of India to encourage 'Make in India' and promote manufacturing and production of Goods and Services in India with a view to enhancing income and employment. In this regard, the following guidelines, concerning the procedure to be adopted for granting purchase preference to local suppliers, are hereby issued:

1.0 Definitions:

a) **'Local content'** means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the goods, services or works procured (excluding net domestic indirect taxes) minus the value of imported content in the goods, services or works (**including all customs duties**) as a proportion of the total value, in percent

b) **'Class-I local supplier'** means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed.

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for 'Class-I local supplier'.

'Non-Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier'.

c) **'L 1'** means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

d) **'Margin of purchase preference'** means the maximum extent to which the evaluated bid price of a 'Class-I local supplier' may be above the L1 for the purpose of purchase preference.

e) **Fraud Prevention Policy** - shall mean the policy related to prevention of fraud displayed on NTPC tender website <http://www.ntpctender.com>.

f) **Policy & Procedure for Debarment from Business Dealings** – shall mean the policy related to Debarment from Business Dealings forming part of Bidding Document.

2.0 Minimum local content

2.1 The minimum local content shall be 50%.

3.0 Margin of Purchase Preference

3.1 The margin of purchase preference shall be 20%.

4.0 Requirement of Purchase Preference:

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- (i) The 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:
- Among all qualified bids and substantially responsive bids, the lowest evaluated bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1.
 - If L1 is not 'Class-I local supplier', the lowest evaluated bidder among the 'Class-I local supplier', will be invited to match the lowest evaluated bid (L1) price subject to Class-I local supplier's evaluated price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the lowest evaluated bid (L1) price.
 - In case such lowest eligible 'Class-I local supplier' fails to match the lowest evaluated bid (L1) price, the 'Class-I local supplier' with the next higher evaluated bid within the margin of purchase preference shall be invited to match the lowest evaluated bid (L1) price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the lowest evaluated bid (L1) price, the contract may be awarded to the L1 bidder.
- (ii) "Class-II local supplier" will not get purchase preference in any procurement.
- (iii) For the purpose of matching of lowest evaluated bid (L1) price, the Class-I local supplier would have to necessarily reduce all components of the quoted price on pro-rata basis. The reduction should not apply on the evaluation loading on account of functional guarantees and other loadings (if any, which are not dependent on quoted price). Further, the Contract shall be awarded on such revised/ reduced quoted price. The summation of the revised / reduced quoted price and the evaluation loading on account of functional guarantees and other loadings (if any) shall be equal to the lowest evaluated bid (L1) price.

Bidder has to submit Declaration of Local Content as per format attached at ATTACHMENT – 17 of section VII (Part 1 of 3) along with the techno commercial bid.

5.0 Verification of Local Content:

5.1 The 'Class-I local supplier'/'Class-II local supplier' shall be required to provide, in the Bid Form/relevant Attachment of Techno- Commercial Bid, self-certification /declaration that the Item offered meets the local content requirement for 'Class-I local supplier'/'Class-II local supplier' and shall give details of the location(s) at which the local value addition is made.

5.2 In case the total bid price of the supplier / bidder is in excess of INR 10 crore, the 'Class-I local supplier'/'Class-II local supplier' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or

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from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content during execution prior to submission of last bill for payment.

In case aforesaid Certificate furnished by Contractor/Vendor is not in line with the declaration in respect of Local content in their bid, same shall be treated as false declaration.

5.3 Deleted

5.4 False declarations will be dealt in line with the Fraud Prevention Policy and Policy & Procedure for Withholding and Banning of Business Dealings of NTPC.

5.5 In case of false declaration / violation of the provision of PPP-MII Order, if a bidder has been debarred / banned by NTPC, then the fact and duration of debarment should be promptly brought to the notice of the Member-Convenor of the Standing Committee (as per para 16 of PPP-MII Order) and the Department of Expenditure through Ministry of Power, GOI.

5.6 A supplier who has been debarred / banned by any other procuring entity for violation of 'Public Procurement (Preference to Make In India), Order 2017' (PPP-MII Order) dated 15.06.2017 and its subsequent revisions / amendments issued by Department of Industrial Policy and Promotion (DIPP) shall not be eligible for evaluation/ preference, as applicable, under the aforesaid procedures for duration of the debarment. The 'Class-I local supplier'/ 'Class-II local supplier' shall be required to furnish a confirmation in this regard in the Bid Form/relevant Attachment of Techno-Commercial Bid.

6.0 Local Sourcing

6.1 The Bidder/its Sub-vendors must be Class-I local supplier for Item(s) mentioned at clause no. 41 of GTR in Technical Specifications, as applicable, in case such item(s) are Self Manufactured/Bought-out.

6.2 The Bidder / Contractor are requested to encourage and promote domestic manufacturing and production of goods and services by sourcing goods and services applicable under the contract / package from domestic suppliers / service providers. In this regard, Bidder shall also follow guidelines / advisory issued by Government of India from time to time, to the extent applicable to them, regarding promotion of local sourcing of goods including Bought out Items and services.

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**Format of Undertaking
(To be sent by Issuing Bank through official email-ID)**

From: xxxbank@xx.in

To: xxx@ntpc.co.in

We have issued BG No. dated for an amount of Rs. on behalf of [Name of Bidder] towards Bid Security / EMD for Tender No. in favour of [Name of Employer].

Please find enclosed the soft copy of the Bank Guarantee and SFMS acknowledgement. This SFMS is sent on (date).

Any demand / claim made by the 'Employer' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder till the validity period mentioned in the Bank Guarantee.

However, in absence of the physical copy of aforementioned BG with the Employer, we undertake that Employer's demand / claim will be binding and conclusive on us without the physical copy of aforementioned BG till ten (10) days from the due date of submission of Techno-Commercial bids.

We undertake not to cancel the aforementioned BG No. without written consent / instruction from NTPC.

(Name of Bank Official)

Authority No.

***NTPC VIDYUT VYAPAR NIGAM
LIMITED***

(A wholly owned Subsidiary of NTPC Limited)



SECTION – IV

***GENERAL CONDITIONS OF CONTRACT
(GCC)***

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Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			A. Contract and Interpretation
1.	Definitions	1.1	<p style="text-align: center;">Definitions</p> <p>The following words and expressions shall have the meanings hereby assigned to them:</p> <p>“Contract” means the Contract Agreement entered into between the Employer and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term “the Contract” shall in all such documents be construed accordingly.</p> <p>“Contract Documents” means the documents listed in Article 1.1 (Contract Documents) of the Form of Contract Agreement (including any amendments thereto).</p> <p>“GCC” means the General Conditions of Contract hereof.</p> <p>“SCC” means the Special Conditions of Contract.</p> <p>“Day” means calendar day of the Gregorian Calendar.</p> <p>“Month” means calendar month of the Gregorian Calendar.</p> <p>“Employer” means the person named as such in the SCC and includes the legal successors or permitted assigns of the Employer.</p> <p>"Project Manager" means the person appointed by the Employer in the manner provided in GCC Sub-Clause 17.1 (Project Manager) hereof and named as such in the SCC to perform the duties delegated by the Employer.</p> <p>“Contractor” means the person(s) whose bid to perform the Contract has been accepted by the Employer and is named as such in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.</p> <p>“Contractor’s Representative” means any person nominated by the Contractor and approved by the Employer in the manner provided in GCC Sub-Clause 17.2 (Contractor’s Representative and Construction Manager) hereof to perform the duties delegated by the Contractor.</p> <p>“Subcontractor/ Subvendor,” means any person to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant and Equipment, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.</p> <p>“Contract Price” means the sum specified in Article 2.1 (Contract Price) of the Contract Agreement, subject to such additions and adjustments thereto or deductions there from, as may be made pursuant to the Contract.</p> <p>“Facilities” means the Plant and Equipment to be supplied and installed, as well as all the Installation Services and Civil Works to be carried out by the Contractor under the Contract.</p>

Clause No.	GENERAL CONDITIONS OF CONTRACT (GCC)
	<p>“Plant and Equipment” means permanent plant, equipment, machinery, apparatus, articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor under GCC Sub-Clause 7.3 hereof), but does not include Contractor’s Equipment.</p> <p>“Installation Services” means all those services ancillary to the supply of the Plant and Equipment for the Facilities, to be provided by the Contractor under the Contract; e.g., transportation and provision of marine or other similar insurance, inspection, expediting, Site preparation works (including the provision and use of Contractor’s Equipment and the supply of all construction materials required), installation, testing, pre-commissioning, commissioning, operations & maintenance and all such services, acts, deeds and things required for achieving Completion of Facilities, the provision of operations and maintenance manuals, training of Employer’s Personnel etc.</p> <p>“Contractor’s Equipment” means all plant, facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant and Equipment, or other things intended to form or forming part of the Facilities.</p> <p>“Site” means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.</p> <p>“Effective Date” means the date from which the Time for Completion shall be determined as stated in Article 3 (Effective Date for Determining Time for Completion) of the Form of Contract Agreement.</p> <p>“Time for Completion” means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained in accordance with the stipulations in the SCC and the relevant provisions of the Contract.</p> <p>“Completion” means that the Facilities (or a specific part thereof where specific parts are specified in the SCC) have been completed operationally and structurally and put in a tight and clean condition, and that all work in respect of Pre-commissioning of the Facilities or such specific part thereof has been completed; and Commissioning has been attained as per Technical Specifications.</p> <p>“Pre-commissioning” means the testing, checking and other requirements specified in the Technical Specifications that are to be carried out by the Contractor in preparation for Commissioning as provided in GCC Clause 24 (Completion) hereof.</p> <p>“Commissioning” means trial/initial operation of the Facilities or any part thereof by the Contractor, which operation is to be carried out by the Contractor as provided in GCC Sub-Clause 25.1 (Commissioning) hereof, for the purpose of carrying out Guarantee Test(s).</p> <p>“Guarantee Test(s)” means the test(s) specified in the Technical Specifications to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>in the Technical Specifications in accordance with the provisions of GCC Sub-Clause 25.2 (Guarantee Test) hereof.</p> <p>“Operational Acceptance” means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor’s fulfilment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of GCC Clause 28 (Functional Guarantees) hereof and shall include deemed acceptance in accordance with GCC Clause 25 (Commissioning and Operational Acceptance) hereof.</p> <p>“Defect Liability Period” means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in GCC Clause 27 (Defect Liability) hereof.</p> <p>“Goods and Services Tax” or “GST” means taxes levied under the Central Goods and Services Tax Act, Integrated Goods and Services Tax Act, Goods and Services Tax (Compensation to States) Act, and various State/Union Territory Goods and Services Tax Laws and applicable cesses, if any under the laws in force (hereinafter referred to as relevant GST Laws).</p> <p>“Trial Operation” - As defined in Technical Specification/Grid Code</p> <p>“Commercial Operation Declaration” - As defined in Technical Specification/Grid Code</p>
	1.2	<p>“Sub-contractor from a country which shares a land border with India” means;</p> <p>a) An entity incorporated, established or registered in such a country; or</p> <p>b) A subsidiary of an entity incorporated, established or registered in such a country; or</p> <p>c) An entity substantially controlled through entities incorporated, established or registered in such a country; or</p> <p>d) An entity whose beneficial owner is situated in such a country; or</p> <p>e) An Indian (or other) agent of such an entity; or</p> <p>f) A natural person who is a citizen of such a country; or</p> <p>g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
	1.2.1	<p>The beneficial owner for the purpose of clause “1.2” above will be as under;</p> <p>a) In case of company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.</p> <p>Explanation</p> <p>i. “Controlling ownership interest” means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company;</p> <p>ii. “Control” shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholdings or management rights or shareholders agreements or voting agreements;</p> <p>b) In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more judicial person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;</p> <p>c) In case of an unincorporated associations or body of individuals, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;</p> <p>d) Where no natural person is identified under (a) or (b) or (c) above, the beneficial owner is the relevant natural person who holds the position of senior managing officials;</p> <p>e) In case of a trust, the identifications of beneficial owner(s) shall include identification of the author of trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.</p>
	1.2.2	<p>An Agent for the purpose of clause “1.2” is a person employed to do any act for another, or to represent another in dealings with third person:</p> <p>[Note: i. A person who procures and supplies finished goods from an entity from a country which shares a land border with India will, regardless of the nature of his legal or commercial relationship with the producer of the goods, be deemed to be an Agent.</p> <p>ii. However, a person who only procures raw material, components etc. from an entity from a country which shares a land border with India and then manufactures or converts them into other goods will not be treated as an Agent.]</p>
2.	Contract Documents	
	2.1	<p>Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
		2.2	The Contract will be signed in three originals and the Contractor shall be provided with one signed original and the rest will be retained by the Employer.
		2.3	The Contractor shall provide free of cost to the Employer all the engineering data, drawing and descriptive materials submitted with the bid, in at least three (3) copies to form a part of the Contract immediately after Notification of Award.
		2.4	Subsequent to signing of the Contract, the Contractor at his own cost shall provide the Employer electronic version of the signed Contract Agreement on CD-ROM/ USB drive within thirty (30) days of its signing.
3.	Interpretation		
		3.1	Language
		3.1.1	Unless the Contractor is a national of the Employer's country and the Employer and the Contractor agree to use the local language, all Contract Documents, all correspondence and communications to be given, and all other documentation to be prepared and supplied under the Contract shall be written in English, and the Contract shall be construed and interpreted in accordance with that language.
		3.1.2	If any of the Contract Documents, correspondence or communications are prepared in any language other than the governing language under GCC Sub-Clause 3.1.1 above, the English translation of such documents, correspondence or communications shall prevail in matters of interpretation.
		3.1.3	The English Translation of the documents shall be carried out by professional translators and the translator shall certify that he is proficient in both languages in order to translate the document and that the translation is complete and accurate. Further, translation shall be authenticated by the Indian Consulate located in the Country where the documents have been issued or the Embassy of that Country in India.
		3.2	Singular and Plural The singular shall include the plural and the plural the singular, except where the context otherwise requires.
		3.3	Headings The headings and marginal notes in the General Conditions of Contract are included for ease of reference, and shall neither constitute a part of the Contract nor affect its interpretation.
		3.4	Persons Words importing persons or parties shall include firms, corporations and government entities.
		3.5	Incoterms

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms.</p> <p>Incoterms means international rules for interpreting trade terms published by the International Chamber of Commerce (latest edition), 38 Cours Albert 1er, 75008 Paris, France.</p>
	3.6	Construction of the Contract
	3.6.1	<p>The Contracts to be entered into between the Employer and the successful bidder shall be as under:</p> <p>For Foreign Contractor</p> <ul style="list-style-type: none"> - First Contract: For CIF (Indian Port-of-Entry) Supply of all Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from abroad. - Second Contract: For Ex-Works (India) Supply of all Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country. - Third Contract: For providing all services excluding Civil Works i.e. port handling, port clearance and port charges for the imported goods, Custom reconciliation, further loading, inland transportation for delivery at site, inland transit insurance, unloading, storage, handling at site, installation, insurance covers other than inland transit insurance, testing, commissioning and conducting Guarantee tests in respect of all the equipment's supplied under the 'First Contract' and the 'Second Contract', and all other services as specified in the Contract Documents. - Fourth Contract: For Civil Works as specified in the Contract Documents <p>If the foreign bidder has proposed an Assignee in his bid to execute the Second Contract and/or the Third Contract and/or the Fourth Contract and has also furnished written unequivocal consent of the proposed Assignee to work as independent Contractor on the terms and conditions offered by the bidder and if the Employer is satisfied with capacity and experience of the Assignee, the Employer will enter into the 'Second Contract' and/or 'Third Contract' and/or Fourth Contract with the said Assignee. In case no Assignee has been proposed by the foreign bidder in his bid or if the Assignee fails to enter into the Second Contract and/or Third Contract and/or Fourth Contract with the Employer or if the Employer in its judgement does not find acceptance of the proposed Assignee as its Contractor, then the foreign bidder shall be obliged to enter into and execute all the four Contracts with the Employer.</p> <p>If the Employer accepts to enter into Second Contract and/or Third Contract and/or Fourth Contract with the Assignee of foreign bidder, the said Assignee, in addition to the Contract Performance Securities to be provided by the foreign Contractor for ten percent (10%) of the value of all the four Contracts, i.e. First Contract, Second Contract, Third Contract and Fourth Contract shall provide within twenty eight (28) days of Notification of Award, separate Contract Performance Security(ies) equivalent to ten percent (10%) of the value of the Contract(s) entered into with the Assignee for the due performance of the Contract, with an initial</p>

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			<p>validity upto ninety (90) days beyond the scheduled Defects Liability Period.</p> <p>For Domestic Contractor</p> <ul style="list-style-type: none"> - First Contract: For CIF (Indian Port-of-Entry) Supply of all Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from abroad. - Second Contract: For Ex-Works (India) Supply of all Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country. - Third Contract: For providing all services excluding Civil Works i.e. port handling, port clearance and port charges for the imported goods, Custom reconciliation, further loading, inland transportation for delivery at site, inland transit insurance, unloading, storage, handling at site, installation, insurance covers other than inland transit insurance, testing, commissioning and conducting Guarantee tests in respect of all the equipment's supplied under the 'First Contract' and the 'Second Contract', and all other services as specified in the Contract Documents. - Fourth Contract: For Civil Works as specified in the Contract Documents.
		3.6.2	The award of separate Contracts shall not in any way dilute the responsibility of the Contractor for the successful completion of the Facilities as per Contract Documents and a breach in one Contract shall automatically be construed as a breach of the other Contract(s) which will confer a right on the Employer to terminate the other Contract(s) also at the risk and the cost of the Contractor.
		3.7	<p>Entire Agreement</p> <p>Subject to GCC Sub-Clause 16.4 hereof, the Contract constitutes the entire agreement between the Employer and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract.</p>
		3.8	<p>Amendment</p> <p>No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly states that it is an amendment to the Contract, and is signed by a duly authorized representative of each party hereto.</p>
		3.9	<p>Independent Contractor</p> <p>The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the parties hereto.</p> <p>Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives or Subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Employer, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create</p>

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			any contractual relationship between any such employees, representatives or Subcontractors and the Employer.
		3.10	<p>Joint Venture or Consortium</p> <p>If the Contractor is a joint venture or consortium of two or more firms, all such firms shall be jointly and severally bound to the Employer for the fulfilment of the provisions of the Contract and shall designate one of such firms to act as a leader with authority to bind the joint venture or consortium. The composition or the constitution of the joint venture or consortium shall not be altered without the prior consent of the Employer.</p>
		3.11	<p>Non-Waiver</p> <p>3.11.1 Subject to GCC Sub-Clause 3.11.2 below, no relaxation, forbearance, delay or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect or restrict the rights of that party under the Contract, nor shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.</p> <p>3.11.2 Any waiver of a party's rights, powers or remedies under the Contract must be in writing, must be express and dated and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.</p>
		3.12	<p>Severability</p> <p>If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.</p>
		3.13	<p>Country of Origin</p> <p>"Origin" means the place where the materials, equipment and other supplies for the Facilities are mined, grown, produced or manufactured, and from which the services are provided.</p>
4.	Notices	4.1	<p>Unless otherwise stated in the Contract, all notices to be given under the Contract shall be in writing, and shall be sent by personal delivery, airmail post, special courier, or e-mail to the address of the relevant party set out in the Contract Coordination Procedure to be finalised pursuant to GCC Sub-Clause 17.2.3.1, with the following provisions.</p> <p>4.1.1 Any notice sent by airmail post or special courier shall be deemed (in the absence of evidence of earlier receipt) to have been delivered ten (10) days after despatch. In proving the fact of despatch, it shall be sufficient to show that the envelope containing such notice was properly addressed, stamped and conveyed to the postal authorities or courier service for transmission by airmail or special courier.</p> <p>4.1.2 Any notice delivered personally or sent by e-mail shall be deemed to have been delivered on date of its despatch.</p>

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		4.1.3	Either party may change its postal or e-mail address or addressee for receipt of such notices by ten (10) days' notice to the other party in writing.
		4.2	Notices shall be deemed to include any approvals, consents, instructions, orders and certificates to be given under the Contract.
5.	Governing Laws		
		5.1	The Contract shall be governed by and interpreted in accordance with laws in force in India. The Courts of Delhi shall have exclusive jurisdiction in all matters arising under the Contract.
6.	Settlement of Disputes		
		6.1	<p>Mutual Consultation</p> <p>If any dispute of any kind whatsoever shall arise between the Employer and the Contractor in connection with or arising out of the Contract, including without prejudice to the generality of the foregoing, any question regarding its existence, validity or termination, or the execution of the Facilities, whether during the progress of the Facilities or after their completion and whether before or after the termination, abandonment or breach of the Contract, the parties shall seek to resolve any such dispute or difference by mutual consultation.</p> <p>On reference of such a dispute by either party, the Employer shall invite the Contractor for mutual consultation, within seven (07) working days of such reference.</p> <p>Without admitting the Employer's liability, the Employer may obtain, within 30 days of such reference of the dispute, further details from the Contractor and examine it relating to the dispute. Such examination (if any) by the Employer shall not be construed as or imply acceptance of the claim or liability or completeness of the details set forth in such request or reference. The Employer may hold discussions with Contractor with an effort to resolve the dispute.</p> <p>If the parties fail to resolve such a dispute or difference by mutual consultation within a period of forty-five (45) days from the date of receipt of reference of such dispute or within such extended period as the parties shall agree in writing, then the dispute may be settled through Independent Engineer (if applicable) and/ or Mediation through Independent External Monitors (if applicable) and/or through Conciliation and/or Arbitration (if applicable) / other remedies available under the applicable laws.</p> <p>Notwithstanding anything contained in any other law for the time being in force, the parties shall keep confidential all matters relating to the Mutual consultation proceedings. Confidentiality shall extend also to any agreement reached during Mutual consultation, except where its disclosure is necessary for purposes of implementation and enforcement.</p> <p>The parties shall not rely on or treat as evidence in Independent Engineer/ Mediation/ Conciliation and in any way Arbitral or Judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of the Mutual consultation proceedings-</p>

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		<p>a) views expressed or suggestions made by the other party in respect of a possible settlement of the dispute;</p> <p>b) admissions made by the other party in the course of the mutual consultation proceedings;</p> <p>c) the fact that the other party had indicated his willingness to accept a proposal for mutual settlement.</p>
	6.2	<p>Resolution of Dispute through Independent Engineer (IE)</p> <p>If the parties fail to resolve the dispute or difference by mutual consultation within the period specified at Cl. 6.1 above, the dispute shall be referred to Independent Engineer (IE), as follows:</p> <p>I. Appointment, Selection and Removal of IEs/Experts:</p> <p>i) The Employer and Contractor shall jointly select only one Member for the Contract from the panel of Experts, to be notified by Ministry of Power, and communicated to Contractor by Employer. For the joint selection process, after the award of the contract, the Contractor shall shortlist at least 3 Experts from the 'Panel of Experts as Independent Engineer', as notified and amended from time to time by Ministry of Power and send to EMPLOYER who shall appoint one of them as 'Independent Engineer' for the Contract.</p> <p>The Expert would be designated as 'Independent Engineer' (IE) for the contract. Appointment of IE/ Expert shall be finalized within twenty-eight (28) days from the date of award of Contract, or, from the date of communication of Panel of Experts to the Contractor by Employer, whichever is later.</p> <p>ii) The initial term of appointment of IE would be for a period of five (5) years or contract period whichever is lesser and may be further renewed on a year-on year basis as may be mutually agreed between the Employer and the Contractor subject to the consent of IE and final approval by the Ministry of Power.</p> <p>iii) It will be mandatory for the IE to visit the site once in every two months to be constantly aware of the ongoing project activities and to have a fair idea of any situation that may lead to disagreement between the parties. Further, additional visits may also be undertaken as and when called upon to address issues of disagreements.</p> <p>iv) Employer or Contractor will not be able to change the IE in any case. In case of adverse finding about IE such as not performing duties or complaints of integrity, that Expert would be dropped by the Ministry from the panel itself and a new Expert would be selected by the Employer and Contractor jointly from the panel for performing the duties of IE.</p> <p>II. Standard Operating Procedure (SOPs) for Independent Engineer (IE)</p> <p>i) IE shall act as per the Standard Operating Procedures (SOPs) attached at Annexure-C to GCC.</p>

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		<p>ii) Resolution by IE shall commence when the claimant Party submits detailed information as per Standard Format (for Disagreement Case filing attached as Annexure-D to GCC) to IE for intervention along with the necessary documentary evidences. Demand for IE intervention will not be admissible without initial documentary evidence.</p> <p>iii) Necessary information sought by IE during the course of investigation shall be provided in a time bound manner by both the Parties and non-compliance of the same shall lead to imposition of penalties, as specified in Special Conditions of Contract (SCC).</p> <p>iv) IE will examine the issue(s) raised by the Parties concerned as mentioned at point number (ii) above by conducting inspections involving field measurements as may be required to further investigate and to also conduct hearing/mediation with both the parties.</p> <p>v) Based on the preliminary hearing of the parties, IE shall prescribe resolution timeline depending upon the number and nature of disagreements subject to a maximum duration of thirty (30) days or within extended timeline under extraordinary circumstances and for reasons to be recorded in writing.</p> <p>vi) There shall not be any conflict of interest and it shall be ensured that IE should not have been engaged for providing any other services to any of the parties i.e. either Employer or Contractor in the last three years. An Undertaking in this regard shall be furnished by the Contractor for the purpose of avoiding any conflict of interest, at the time of bidding and finalization of IE/ Expert.</p> <p>vii) In the event of non-performance of obligations/services by the IEs at any time during the duration of its contract, the Employer and the Contractor, on mutually agreed basis, shall have the right and discretion to terminate IEs contract by giving a termination notice of thirty (30) days to IEs.</p> <p>viii) The role of 'Independent Engineer' under the Contract is an impartial and fair exercise, where the 'Independent Engineer' has to act as a neutral third-party facilitator. The decision of Independent Engineer shall not be binding on the parties unless the parties sign the written settlement agreement and the same is authenticated by IE. Such Settlement agreement would then be binding on the parties and both parties shall implement the same forthwith.</p> <p>III. Terms and Conditions for Payments to 'Independent Engineer' -</p> <p>i) Retainership Fee: A retainer fee, as specified in Special Conditions of Contract (SCC), for 'Independent Engineer for a specific project shall be considered as payment in full for:</p> <p>a. being available on a notice of 2 weeks for all site visits and hearings,</p> <p>b. becoming and remaining conversant with all the project developments and maintaining relevant files;</p>

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	<p>c. compensating all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and</p> <p>The retainer fee of Experts, shall be increased annually by 10%. Further, an Expert, shall not be in the retainerhip of more than two contracts concurrently in Employer's Organization. In case of two contracts, expert shall draw retainerhip fee limited to one contract only (i.e. the amount specified in Special Conditions of Contract (SCC)). The duration of retainerhip shall be for such duration as may be mutually decided by the Employer and Contractor but shall not, in any case, extend beyond 3 months after the completion of works as per the contract.</p> <p>The retainerhip fee shall be shared by the Employer and the Contractor equally but shall initially be paid to the IE by the Employer.</p> <p>ii) Site Visit Fee: A daily visiting fee, as specified in Special Conditions of Contract (SCC), to either project site or project office, anywhere in India, limited to a maximum of 10 days in a month for Expert, shall be paid for hearing, preparing reports etc initially by the Employer. The daily visiting fee of Expert shall be increased on yearly basis @10%.</p> <p>iii) Reimbursement of travel, boarding/lodging expenses incurred by Independent Engineer: The travel, boarding/lodging expenses of the 'Independent Engineer', as per entitlement of Executive Director of Employer, would be made initially by the Employer. If any expert of 'Independent Engineer does not receive payment of the amount due within 30 days after submitting claim, the expert shall be free to suspend his/her services without notice until the payment is received.</p> <p>iv) Meeting Expenses: All the payments for holding the meeting would be initially borne by the Employer and shall be shared equally by the Employer and Contractor.</p> <p>v) Sharing of Expenses on Independent Engineer: All the payments for holding the meeting, site visits, reimbursement of travel, boarding/lodging expenses and monthly compensation of Independent Engineer' shall be shared equally by both the parties i.e. Employer and Contractor.</p> <p>vi) The Employer shall maintain an account of all the expenses incurred by it on 'Independent Engineer'.</p> <p>Notwithstanding anything contained in any other law for the time being in force, the Independent Engineer and the parties shall keep confidential all matters relating to the Independent Engineer proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of implementation and enforcement.</p> <p>The parties shall not rely on or treat as evidence in Mediation/ Conciliation and in any way Arbitral or Judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of the Independent Engineer proceedings,</p>

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		<p>a) views expressed or suggestions made by the other party in respect of a possible settlement of the dispute;</p> <p>b) admissions made by the other party in the course of the Independent Engineer proceedings;</p> <p>c) proposals made by the Independent Engineer; and</p> <p>d) the fact that the other party had indicated his willingness to accept a proposal for settlement made by the Independent Engineer.</p>
	6.3	<p>Mediation through Independent External Monitors (IEMs)</p> <p>If the parties fail to resolve a dispute or difference by mutual consultation and through Independent Engineer (if applicable) within a period specified at Cl. 6.1 and 6.2 above, the dispute, if the parties agree, may be referred to the Panel of IEMs for Mediation.</p> <p>The Mediation proceedings shall be completed in a time bound manner, in not more than 45 days from the date of reference to IEMs for Mediation.</p> <p>The IEMs may conduct the Mediation proceedings in the manner, they consider appropriate. In case of 3-member Panel of IEMs, 2 members will constitute a valid quorum and the meeting can take place to proceed in the matter after seeking consent from the member who is not available. However, IEMs recommendations will be signed by all the members.</p> <p>The fees for such meetings shall be as specified in the SCC. The travel and stay arrangement for such meetings shall be equal to that of Independent Board Member of Employer's Organization. However, not more than five meetings shall be held for a particular dispute resolution. The fees/ expenses on dispute resolution shall be equally shared by both the parties.</p> <p>If decision of IEMs is acceptable to both the parties, a Settlement Agreement will be signed to the extent agreed by the parties within 15 days of acceptance by the parties and same shall be authenticated by all the IEMs.</p> <p>Notwithstanding anything contained in any other law for the time being in force, the Mediator and the parties shall keep confidential all matters relating to the Mediation proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of implementation and enforcement.</p> <p>The parties shall not rely on or treat as evidence in Conciliation and in any way Arbitral or Judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of the Mediation proceedings, —</p> <p>a) views expressed or suggestions made by the other party in respect of a possible settlement of the dispute;</p> <p>b) admissions made by the other party in the course of the Independent Engineer proceedings;</p>

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		<p>c) proposals made by the Independent Engineer; and</p> <p>d) the fact that the other party had indicated his willingness to accept a proposal for settlement made by the Independent Engineer.</p>
	6.4	<p>Resolution of Dispute through Conciliation</p> <p>If the parties fail to resolve such a dispute or difference by mutual consultation and through Independent Engineer (if applicable) and/or through Mediation (if applicable) within a period as specified at Cl. 6.1, 6.2 and 6.3 above, the dispute if the parties agree, may be referred to Conciliation.</p> <p>(i) For cases where the disputed amount (Claim/ Counter claim, whichever is higher) is upto Rs. 25 Cr. (excluding interest), the matter for conciliation shall be referred to Expert Settlement Council (ESC), constituted by Employer.</p> <p>(ii) For cases where the disputed amount (Claim/ Counter claim, whichever is higher) is above Rs. 25 Cr. (excluding interest), the matter for conciliation shall be referred to Conciliation Committee of Independent Experts (CCIE), constituted by Ministry of Power (MoP).</p> <p>If the claim/Counter-claim is in foreign currency, the SBI Bills Selling Exchange rate prevailing on the date of claim shall be used for the purpose of converting the claim in Indian Rupee.</p> <p>The Conciliation process shall be conducted as per Part III of the Arbitration and Conciliation Act, 1996.</p> <p>In case of failure of the conciliation process at the level of the CCIE, the parties may withdraw from conciliation process and take recourse to the Arbitration proceedings or the laid down legal process of Courts.</p> <p>6.4.1.Resolution of Dispute through Expert Settlement Council (ESC), constituted by EMPLOYER {For cases with Disputed amount (Claim/ Counter claim, whichever is higher) upto Rs. 25 Crore excl. interest}</p> <p>If the parties fail to resolve such a dispute or difference by mutual consultation and through Independent Engineer (if applicable) and/or through Mediation (if applicable) within a period specified at Cl. 6.1, 6.2 and 6.3 above, the dispute, if the parties agree, may be referred to Conciliation through Expert Settlement Council (ESC), in cases where the Disputed amount (Claim/ Counter claim, whichever is higher) is upto Rs.25crore (excl. interest).</p> <p>6.4.1.1. Invitation for Conciliation through ESC:</p> <p>6.4.1.1.1. A party shall notify the other party in writing about such a dispute it wishes to refer for Conciliation through ESC within a period of 15 days from the date of failure to resolve the dispute through Mutual Consultation and Independent Engineer (if applicable)</p>

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		<p>and/or through Mediation (if applicable) within a period as specified at Cl. 6.1, 6.2 and 6.3 above. Such Invitation for Conciliation shall contain sufficient information as to the dispute to enable the other party to be fully informed as to the nature of the dispute, amount of the monetary claim, if any, and apparent cause of action.</p> <p>6.4.1.1.2. Upon acceptance of the invitation to conciliate, the other party shall submit its counter claim, if any, within a period of 15 days from the date of the invitation to conciliate. If the other party rejects the invitation or Disputed amount (Claim/ Counter claim, whichever is higher) exceeds Rs 25crore (excl. Interest), there will be no Conciliation proceedings through ESC.</p> <p>There shall be no Conciliation where disputed amount (Claim/ Counter claim, whichever is higher excl. interest) is only up to Rs 5 lakhs.</p> <p>6.4.1.1.3. If the party initiating Conciliation does not receive a reply within fifteen (15) days from the date on which it sends the invitation, or within such other period of time as specified in the invitation, it shall treat this as a rejection of the invitation to conciliate from the other party.</p> <p>6.4.1.2. Conciliation through ESC:</p> <p>6.4.1.2.1. Where Invitation for Conciliation has been furnished under GCC sub clause 6.4.1.1, the parties shall attempt to settle such dispute through Expert Settlement Council (ESC) which shall be constituted by CMD/Chairman of Employer.</p> <p>6.4.1.2.2. ESC will be formed from experts comprising three members from the panel of Conciliators maintained by EMPLOYER. However, there will be single member ESC for disputes involving disputed amount (Claim/ Counter claim, whichever is higher excl. interest) is up to Rs. 1 crore.</p> <p>CMD/ Chairman of Employer shall have the authority to reconstitute the ESC to fill any vacancy.</p> <p>6.4.1.2.3. The ESC shall be amongst Civil Servants of Govt. of India retired from the level of Joint Secretary and above, Retired Judges, Officers retired from the level of Executive Director and above of any Maharatna /Navratna company in India, other than NTPC Ltd, Retired Independent Directors who have served on the Board of any Maharatna / Navratna company in India, other than NTPC Ltd.</p> <p>6.4.1.3. Proceedings before ESC:</p> <p>6.4.1.3.1. The claimant shall submit its Statement of Claims (SOC) along with relevant documents to ESC members, and to the party(s) indicated in the appointment letter within 15 days of appointment of ESC. The respondent shall file its reply/Statement of Defence (SOD) and counter claim (if any) within 15 days of the receipt of the Statement of claims. Each party shall send a copy of such Statement along with relevant documents to the other party.</p>

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		<p>Parties may file their rejoinder/additional documents, if any in support of their Claim/Counterclaim within next 7 days. No documents shall be allowed thereafter, except with the permission of ESC.</p> <p>6.4.1.3.2. The parties shall file their claim and counterclaim in the following format</p> <ol style="list-style-type: none"> a. Chronology of the dispute b. Brief of the contract c. Brief history of the dispute d. Issues <table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Description of Claims/ Counter claims</th> <th>Amount (in foreign currency/INR)</th> <th>Relevant Contract Clause</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table> <ol style="list-style-type: none"> e. Details of Claim(s)/Counter Claim(s) f. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract) <p>Note: Statement of claims shall be restricted to maximum limit of 20 pages.</p> <p>6.4.1.3.3. In case of 3 members ESC, 2 members will constitute a valid quorum and the meeting can take place to proceed in the matter after seeking consent from the member who is not available. However, ESC recommendations will be signed by all the members.</p> <p>If required, meetings can be conducted through video conferencing/other digital means subject to the agreement between the parties and the ESC.</p> <p>6.4.1.3.4. The parties shall be represented by their in house employees. No party shall be allowed to bring any advocate or outside consultant/advisor/agent to contest on their behalf. Ex-officers of Employer's Organization who have handled the subject matter in any capacity shall not be allowed to attend and present the case before ESC on behalf of contractor. However, ex-employees of parties may represent their respective organizations. Parties shall not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till execution of settlement agreement, if so arrived. In case, parties are unable to reach a settlement, no interest shall be claimed by either party for the period from the date of notice invoking Conciliation till the date of ESC recommendations and 30 days thereafter in any further proceeding.</p> <p>6.4.1.3.5. ESC will conclude its proceedings in maximum 10 meetings, and give its recommendations within 90 days from the date of reference to ESC. ESC will give its recommendations to both the parties recommending possible terms of settlement. CMD/ Chairman of Employer may extend the time/number of meetings, in exceptional cases, if ESC requests</p>	Sl. No.	Description of Claims/ Counter claims	Amount (in foreign currency/INR)	Relevant Contract Clause												
Sl. No.	Description of Claims/ Counter claims	Amount (in foreign currency/INR)	Relevant Contract Clause															

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)																														
		<p>for the same with sufficient reasons and as agreed by the parties.</p> <p>6.4.1.3.6. Depending upon the location of ESC members and the parties, the venue of the ESC meeting shall be either Delhi/Mumbai/Kolkata/Chennai or any other city whichever is most economical from the point of view of travel and stay etc. All the expenditure incurred in ESC proceedings shall be shared by the parties in equal proportion.</p> <p>6.4.1.4. Fees & Facilities to the Members of the ESC</p> <p>The cost of Conciliation proceedings including but not limited to fees for Conciliator, Airfare, Local transport, Accommodation, cost towards conference facility etc shall be as provided herein below:</p> <table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Fees/ Facility</th> <th>Entitlement</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Fees</td> <td>Rs. 25,000 per meeting subject to max. of Rs. 2,50,000 per case per Conciliator.</td> </tr> <tr> <td>2</td> <td>Secretarial expenses</td> <td>Rs. 10,000 lump sum (to 1 member only).</td> </tr> <tr> <td>3</td> <td>Transportation in the city of the meeting</td> <td>Car as per entitlement or Rs. 2,000 per day</td> </tr> <tr> <td>4</td> <td>Venue for meeting</td> <td>Employer's conference rooms</td> </tr> <tr> <td colspan="3">Facilities to be provided to the out-stationed member</td> </tr> <tr> <td>5</td> <td>Travel from the city of residence to the city of meeting</td> <td>As per entitlement of Independent Directors. Executive class air tickets / first class AC train tickets/ Luxury car/ reimbursement of actual fare. However, entitlement of air travel by Business class shall be subject to austerity measures, if any, ordered by Govt of India.</td> </tr> <tr> <td>6</td> <td>Transport to and from airport/ railway station in the city of residence</td> <td>Car as per entitlement or Rs. 3,000</td> </tr> <tr> <td>7</td> <td>Stay for out stationed members</td> <td>As per entitlement of Independent Directors.</td> </tr> <tr> <td>8</td> <td>Transport in the city of meeting</td> <td>Car as per entitlement or Rs. 2000 per day</td> </tr> </tbody> </table> <p>Aforesaid fees is subject to revision by Employer from time to time and subject to government guidelines on austerity measures, if any. All the expenditure incurred in the ESC proceedings shall be shared by the parties in equal proportions. The Parties shall maintain the account of expenditure and present to the other for the purpose of sharing on conclusion of</p>	Sl. No.	Fees/ Facility	Entitlement	1	Fees	Rs. 25,000 per meeting subject to max. of Rs. 2,50,000 per case per Conciliator.	2	Secretarial expenses	Rs. 10,000 lump sum (to 1 member only).	3	Transportation in the city of the meeting	Car as per entitlement or Rs. 2,000 per day	4	Venue for meeting	Employer's conference rooms	Facilities to be provided to the out-stationed member			5	Travel from the city of residence to the city of meeting	As per entitlement of Independent Directors. Executive class air tickets / first class AC train tickets/ Luxury car/ reimbursement of actual fare. However, entitlement of air travel by Business class shall be subject to austerity measures, if any, ordered by Govt of India.	6	Transport to and from airport/ railway station in the city of residence	Car as per entitlement or Rs. 3,000	7	Stay for out stationed members	As per entitlement of Independent Directors.	8	Transport in the city of meeting	Car as per entitlement or Rs. 2000 per day
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	<p>the ESC proceedings.</p> <p>6.4.1.5. If recommendations/ report of ESC is acceptable to both the parties, a Settlement Agreement under Section 73 of the Arbitration and Conciliation Act, 1996 will be signed to the extent agreed by the parties within 15 days of acceptance by the parties and same shall be authenticated by all the ESC members.</p> <p>Parties are free to terminate Conciliation proceedings at any stage as provided under the Arbitration and Conciliation Act 1996.</p> <p>6.4.1.6. Notwithstanding anything contained in any other law for the time being in force, the Conciliator and the parties shall keep confidential all matters relating to the Conciliation proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of implementation and enforcement.</p> <p>The parties shall not rely on or treat as evidence in any way in Arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of the Conciliation proceedings,—</p> <ul style="list-style-type: none"> a) views expressed or suggestions made by the other party in respect of a possible settlement of the dispute; b) admissions made by the other party in the course of the Conciliation proceedings; c) proposals made by the Conciliator; and d) the fact that the other party had indicated his willingness to accept a proposal for settlement made by the Conciliator. <p>6.4.2. Resolution of Dispute through Conciliation Committee of Independent Experts (CCIE), constituted by Ministry of Power (MoP) {For cases with Disputed amount (Claim/ Counter claim whichever is higher) above Rs. 25 Crore excl. interest}</p> <p>If the parties fail to resolve such a dispute or difference by mutual consultation and through Independent Engineer (if applicable) and/or through Mediation (if applicable) within a period specified at Cl. 6.1, 6.2, 6.3 above, the dispute, if the parties agree, may be referred to Conciliation Committee of Independent Experts (CCIE), in cases where the Disputed amount (Claim/ Counter claim whichever is higher) is above Rs. 25 crore excl. interest.</p> <p>6.4.2.1. Invitation for Conciliation through CCIE:</p> <p>6.4.2.1.1. A party shall notify the other party in writing about such a dispute it wishes to refer for CCIE within a period of 15 days from the date of failure to resolve the dispute through Mutual Consultation</p>

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	<p>and Independent Engineer (if applicable) and/or through Mediation (if applicable) within a period as specified at Cl. 6.1, 6.2 and 6.3 above. Such Invitation for Conciliation shall contain sufficient information as to the dispute to enable the other party to be fully informed as to the nature of the dispute, amount of the monetary claim, if any, and apparent cause of action.</p> <p>6.4.2.1.2. If the party initiating Conciliation does not receive a reply within fifteen (15) days from the date on which it sends the invitation, or within such other period of time as specified in the invitation, it shall treat this as a rejection of the invitation to conciliate from the other party.</p> <p>6.4.2.2. Conciliation Committee of Independent Experts:</p> <p>6.4.2.2.1. Where Invitation for Conciliation has been consented to under GCC sub clause 6.4.2.1, the same shall be referred to the Conciliation Committee of Independent Experts (CCIE) within 30 days.</p> <p>Conciliation Committees of Independent Experts (CCIE) have been constituted and notified by MoP for settlement of disputes arising in the Contract. There are three CCIEs, as specified in Special Conditions of Contract.</p> <p>6.4.2.2.2. The Contractor may select three CCIEs, in priority order, from the list of CCIEs enclosed with the Special Conditions of Contract, for finalization by Central Electricity Authority (CEA). There shall not be any conflict of interest for the members of the CCIE due to their past assignments. Individuals CCIE members shall submit an undertaking in this regard to the Employer, prior to appointment. It shall be ensured that they have not been engaged for providing any services to any of the parties i.e. either Employer or the Contractor in the last five years. An Undertaking in this regard, shall also be furnished by the Contractor for the purpose of avoiding any conflict of interest.</p> <p>6.4.2.3. Proceedings before CCIE:</p> <p>6.4.2.3.1. The procedure of CCIE shall not be treated as alternate arbitration proceedings where both parties come with Statement of claims/defence, arguments/counter arguments, rejoinders, written submissions etc., aided by their respective lawyers.</p> <p>6.4.2.3.2. The parties shall be brief and to the point before the Committee with regard to their respective stance and view the exercise in the spirit of conciliation/settlement.</p> <p>6.4.2.3.3. The possibility of non-availability of any one of the members of CCIE in any proceedings cannot be ruled out. As such, the Committee comprising the other two members shall be competent to proceed in the matter. The proceedings of the Committee shall not be vitiated if one of the three members of CCIE is not present in the deliberations of the Committee. When the parties sign the settlement agreement, at least two members of CCIE shall authenticate the same. Such conciliation proceedings shall be considered valid and the settlement agreement will be binding on the parties.</p>

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	<p>6.4.2.3.4. The parties shall be represented by their in house employees. No party shall be allowed to bring any advocate or outside consultant/advisor/agent to contest on their behalf. Ex-officers of Employer's Organization who have handled the subject matter in any capacity shall not be allowed to attend and present the case before CCIE on behalf of contractor. However, ex-employees of parties may represent their respective organizations.</p> <p>6.4.2.3.5. The Conciliation proceedings shall be completed in each case through 5 sittings in a period of not more than three months from the date the reference made to the CCIE. In exceptional cases, if any dispute so merits, the time period may be extended at the discretion of Conciliation Committee (with reasons to be recorded in writing), for a further period of three months.</p> <p>6.4.2.3.6. The CCIE shall hold day to day sitting at a suitable place (preferably the headquarter of the Employer or New Delhi) and may hold as many sittings every month as it deems appropriate keeping in view the volume of work.</p> <p>6.4.2.4. Fees & Facilities to the Members of the CCIE</p> <p>Each member of CCIE would be paid a sum of Rs. 50,000/- as sitting fee per sitting. In addition, Rs. 5,000/- per sitting will be paid for local transport charges for each day of proceeding.</p> <p>In case, a particular dispute requires more than 5 sittings, the same may be held at the discretion of the CCIE but with a cap on payment of fee for 5 sittings only. The local transport charges shall, however, be paid as provided for each day of sitting beyond the 5 sittings.</p> <p>All expenditure incurred on the conciliation proceedings including payment of fees to the Conciliators, office space, logistic, secretarial assistance and other incidental expenses etc. shall be borne by the Employer initially. Thereafter it shall be shared equally by both parties on completion of the conciliation process.</p> <p>6.4.2.5. The Parties shall maintain the account of expenditure and present to the other for the purpose of sharing on conclusion of the CCIE proceedings.</p> <p>The Conciliation process shall be conducted under Part III of the Arbitration and Conciliation Act, 1996.</p> <p>In case of failure of the conciliation process at the level of the Conciliation Committee, the parties may withdraw from conciliation process and take recourse to Arbitration proceedings or the laid down legal process of Courts.</p> <p>In the event of the conciliation proceedings being successful, the parties to the dispute would sign the written settlement agreement and the conciliators would authenticate the same. Such settlement agreement would then be binding on the parties in terms of Section 73 of the Arbitration and Conciliation Act, 1996.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>After successful conclusion of proceedings, the Parties to the conciliation process, have to undertake and complete all necessary actions for implementation of the terms of settlement within a period of 30 days from execution of settlement agreement, unless a different timeline not exceeding 60 days is agreed upon in settlement agreement. All pending claims of parties, in connection with the dispute, before any other legal forum are to be withdrawn within the said 30 days in pursuance of the settlement agreement.</p> <p>6.4.2.6. Notwithstanding anything contained in any other law for the time being in force, the Conciliator and the parties shall keep confidential all matters relating to the Conciliation proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of implementation and enforcement.</p> <p>The parties shall not rely on or treat as evidence in any way in Arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of the Conciliation proceedings,—</p> <ol style="list-style-type: none"> a) views expressed or suggestions made by the other party in respect of a possible settlement of the dispute; b) admissions made by the other party in the course of the Conciliation proceedings; c) proposals made by the Conciliator; and d) the fact that the other party had indicated his willingness to accept a proposal for settlement made by the Conciliator. <ol style="list-style-type: none"> a)
	6.5	<p>6.5. Arbitration</p> <p>6.5.1. If the process of mutual consultation and IE (if applicable) and/or Mediation (if applicable) and/or ESC fails to arrive at a settlement between the parties and/or settlement of dispute through CCIE not exercised as mentioned at GCC Sub-Clauses 6.1, 6.2, 6.3, 6.4 above, Employer or the Contractor may, within Thirty (30) days of such failure, give notice to the other party, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given. The mechanism of settling the disputes through arbitration shall be applicable only in cases where the disputed amount (i.e. Claim/ Counter claim, whichever is higher, excluding interest) does not exceed Rs. 25 crores.</p> <p>If the claim/ counter claim is in foreign currency, the SBI Bills Selling Exchange rate prevailing on the date of claim shall be used for the purpose of converting the claim in Indian Rupee</p> <p>In case the disputed amount (Claim/ Counter claim, whichever is higher, excl. interest) exceeds Rs. 25 Crores, the parties shall be within their rights to take recourse to remedies as may be available to them under the applicable laws other than Arbitration after prior intimation to the other party. There shall be no</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>arbitration where the disputed amount (Claim/ counter claim, whichever is higher) is only up to Rs. 5 lakhs.</p> <p>The parties at the time of invocation of arbitration shall submit all the details of the claims and the counter-claims including the Heads/Sub-heads of the Claims/Counter-Claims and the documents relied upon by the parties for their respective claims and counter-claims. The parties shall not file any documents/details of the claims and counter-claims thereafter.</p> <p>The claims and the counter claims raised by the parties at the time of invocation of the arbitration shall be final and binding on the parties and no further change shall be allowed in the same at any stage during arbitration under any circumstances whatsoever.</p> <p>6.5.2. Any dispute in respect of which a notice of intention to commence arbitration has been given, in accordance with GCC Sub Clause 6.5.1, shall be finally settled by arbitration.</p> <p>6.5.3. It is agreed between the parties that the Arbitration proceedings shall be conducted as per the provisions of Fast Track Procedure as provided under The Arbitration and Conciliation Act, 1996, as amended from time to time.</p> <p>Any dispute raised by a party to arbitration shall be adjudicated by a Sole Arbitrator appointed by mutual consent from among the List of empanelled Arbitrators maintained by EMPLOYER, in the following manner:</p> <p>a) A party willing to commence arbitration proceeding shall invoke Arbitration Clause by giving notice to the other party.</p> <p>b) EMPLOYER, shall within 30 days from the receipt of such notice shall send a panel of at least four arbitrators from among its empanelled arbitrators to the Contractor for short listing two among them for such appointment, within 15 days from the date of receipt of the Panel of Arbitrators from EMPLOYER.</p> <p>c) CMD/ Chairman of Employer shall appoint the sole arbitrator from among the two names short listed by the Contractor, within 15 days from the receipt of such nomination. Notice to the Parties of the constitution of the arbitral tribunal shall be issued by EMPLOYER.</p> <p>In case, the contractor fails to inform its shortlisted names for appointment of sole arbitrator from the panel of at least four arbitrators sent by the Employer or no response is received from the contractor, within 15 days from the date of receipt of the Panel of Arbitrators from EMPLOYER, CMD/ Chairman of Employer shall appoint the sole arbitrator from among the four names sent to the contractor earlier.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>d) If the Arbitrator so appointed dies, resigns, becomes incapacitated or withdraws for any reason from the proceedings or his mandate is terminated by the Court, it shall be lawful for CMD/ Chairman of Employer to appoint another person in his place in the same manner as aforesaid. Such person shall proceed with the reference from the stage where his predecessor had left.</p> <p>e) Arbitrator shall be paid fees as per the Fee Schedule (presently Fourth Schedule) provided in 'The Arbitration and Conciliation Act, 1996' as amended from time to time. If the claim/ counter claim is in foreign currency, the SBI Bills Selling Exchange rate prevailing on the date of claim shall be used for the purpose of converting the claim in Indian Rupee which may be used for determining the arbitration fee.</p> <p>f) If after commencement of the Arbitration proceedings, the parties agree to settle the dispute mutually or refer the dispute to mediation or Conciliation, the arbitrator shall put the proceedings in abeyance until such period as requested by the parties. Where the proceedings are put in abeyance or terminated on account of mutual settlement of dispute by the parties, the fees payable to the arbitrator shall be determined as under:</p> <ul style="list-style-type: none"> (i) 40% of the fees if the Pleadings are complete. (ii) 60% of the fees if the Hearing has commenced. (iii) 80% of the fees if the Hearing is concluded but the Award is yet to be passed. <p>g) Each party shall pay its share of arbitrator's fees in stages as under or as per the directions of Arbitrator:</p> <ul style="list-style-type: none"> (i) 40 % of the fees on Completion of Pleadings. (ii) 40% of the fees on Conclusion of the Final Hearing. (iii) 20% at the time when arbitrator notifies the date of final award. <p>h) The Claimant shall be responsible for making all necessary arrangements for the travel/ stay of the Arbitrator including venue of arbitration, hearings. The parties shall share the expenses for the same equally.</p> <p>i) The Arbitration shall be held at Delhi only.</p> <p>j) The Arbitrator shall give reasoned and speaking award and it shall be final and binding on the parties.</p> <p>k) Subject to the aforesaid conditions, provisions of the Arbitration and Conciliation Act, 1996 and any statutory modifications or re-enactment thereof as amended from time to time, shall apply to the arbitration proceedings under this clause.</p>

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			<p>6.5.4. In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract (s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/ Organizations (excluding taxation matters), such disputes or difference shall be taken up by either party for resolution through Administrative Mechanism for Resolution of CPSEs Disputes (AMRCD) as mentioned in DPE Office Memorandum No. 4(1)/2013- DPE(GM)/FTS-1835 dated 22.05.2018 issued by Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Government of India and its further clarifications, modifications and amendments, issued from time to time.</p> <p>The aforesaid limit of Rs 25 crore shall not be applicable and matter may be referred to AMRCD irrespective of the amount involved in dispute, if the dispute could not be resolved through Mutual Consultation and IE (if applicable) as brought out at GCC Sub Clause 6.1 and 6.2 above.</p>
		6.6	<p>Notwithstanding any reference to the Independent Engineer or Mediation or Conciliation or Arbitration herein,</p> <p>(a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree.</p> <p>(b) the Employer shall pay the Contractor any monies due to the Contractor.</p> <p>Settlement of Dispute clause cannot be invoked by the Contractor, if the Contract has been mutually closed or 'No Demand Certificate' has been furnished by the Contractor or any Settlement Agreement has been signed between the Employer and the Contractor.</p>
			B. Subject Matter of Contract
7.	Scope Of Facilities		
		7.1	<p>Unless otherwise expressly limited in the Technical Specifications, the Contractor's obligations cover the provision of all Plant and Equipment including structural steel and the performance of all Installation Services and civil works, allied works etc. required for the design, the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Pre-commissioning and delivery) of the Plant and Equipment and the installation, completion, commissioning and performance testing of the Facilities in accordance with the plans, procedures, specifications, drawings, codes and any other documents as specified in the Technical Specifications. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labour, materials, equipment, spare parts (as specified in GCC Sub-Clause 7.3 below) and accessories; Contractor's Equipment;</p>

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		construction utilities and supplies; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works and services that will be provided or performed by the Employer, as set forth in Appendix 6 (Scope of Works and Supply by the Employer) to the Contract Agreement.
	7.2	The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.
	7.3	<p>In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities. However, the identity, specifications and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in Price Schedule No. 6, which shall be added to the Contract Price. The price of such spare parts shall include the purchase price therefor and other costs and expenses (including the Contractor's fees) relating to the supply of spare parts. Prices of recommended spares covered under price Schedule No. 6 shall be kept valid for a period of six (6) months after placement of Notification of Award for Main Equipment and Mandatory Spares.</p> <p>7.3.1 The Contractor agrees that the spare parts recommended by him for 3 years operation and quoted in Schedule No. 6 shall be supplied by him at the same terms and conditions as are otherwise applicable to this Contract. Further, the Contractor also agrees to supply spare parts required for the operation and maintenance of the Facilities as per provision of subsequent paragraphs of this Sub-Clause.</p> <p>7.3.1.1 All the spares for the equipment under the Contract will strictly conform to the Specification and other relevant documents and will be identical to the corresponding main equipment/ components supplied under the Contract and shall be fully interchangeable.</p> <p>7.3.1.2 The Mandatory Spares covered under the Contract shall be produced in phased manner and the delivery would be completed by the respective dates as per the mutually agreed despatch schedule. In case of Recommended Spares the above will be applicable provided the order for the Recommended Spares have been placed with the Contractor prior to commencement of manufacture of the main equipment.</p> <p>7.3.1.3 The Contractor will provide the Employer with the manufacturing drawings, catalogues, assembly drawings and any other document required by the Employer so as to enable the Employer to identify the recommended spares. Such details will be furnished to the Employer as soon as they are prepared but in any case not later than six months prior to commencement of manufacture of the corresponding main equipment.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>7.3.1.4 To enable the Employer to finalise the requirement of recommended spares which are ordered subsequent to placement of order for main equipment/plant, in addition to necessary technical details, catalogue and such other information brought-out herein above, the Contractor will also provide a justification in support of reasonableness of the quoted prices of spares which will, inter-alia, include documentary evidence that the prices quoted by the Contractor to the Employer are not higher than those charged by him from other customers in the same period.</p> <p>7.3.1.5 In addition to the spares recommended by the Contractor, if the Employer further identifies certain items of spares, the Contractor will submit the prices and delivery quotation for such spares within thirty (30) days of receipt of such request with a validity period of six (6) months for consideration by the Employer and placement of order for additional spares if the Employer so desires.</p> <p>7.3.1.6 The quality plan and the inspection requirement finalised for the main equipment will also be applicable to the corresponding spares.</p> <p>7.3.1.7 The Contractor will provide the Employer with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipment covered under the Contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.</p> <p>7.3.1.8 The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the Contract. The Contractor shall guarantee that before going out of production of spare parts of the equipment covered under the Contract, he shall give the Employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if it so desires. The same provision will also be applicable to Sub-contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor and/or his Sub-contractor, Contractor will provide the Employer, two years in advance, with full manufacturing drawings, material specification and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.</p> <p>7.3.1.9 The prices of all future requirements of item of spares beyond 3 years operational requirement will be derived from the corresponding ex-works price at which the order for such spares have been placed by Employer as a part of mandatory spares or recommended spares, or from the rates of mandatory spares or recommended spares as quoted by/negotiated with the Contractor. Ex-works order price of future spares shall be computed in accordance with the price adjustment provisions covered under the main Contract and there will be no ceiling on the amount of variation in the prices. The above option for procuring future recommended spares by</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>the Employer shall remain valid for the period of 5 years from the date of Commissioning of the equipment.</p> <p>7.3.1.10 The Contractor will indicate in advance the delivery period of the items of spares, which the Employer may procure in accordance with above sub-clause. In case of emergency requirements of spares, the Contractor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.</p> <p>7.3.1.11 In case the Contractor fails to supply the mandatory, recommended spares or long term spares in the terms stipulated above, the Employer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the Contractor and recover from the Contractor, the excess amount paid by the Employer over the rates worked on the above basis. In the event of such risk purchase by the Employer, the purchases will be as per the Works and Procurement Policy of the Employer prevalent at the time of such purchases and the Employer at his option may include a representative from the Contractor in finalising the purchases.</p> <p>7.3.1.12 It is expressly understood that the final settlement between the parties in terms of relevant clauses of the Contract Documents shall not relieve the Contractor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 5 years period reckoned from the scheduled date of Commissioning of the Plant and Equipment unless otherwise discharged expressly in writing by the Employer. Further, the provisions pertaining to long term availability of spares shall be extended beyond 5 years applicability period mentioned hereinabove if so desired by the Employer and at the mutually acceptable escalation formula.</p> <p>7.3.1.13 The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract Documents and will be free from defects in design, material and workmanship and shall further guarantee as under:</p> <p>(i) For 3 years operational spares (both mandatory and recommended)</p> <p>a) For any item of spares ordered or to be ordered by the Employer for 3 years operational requirement of the plant which are manufactured as a continuous operation together with the corresponding main equipment/component, the Defect Liability Period will be twelve (12) months from the scheduled date of commercial operation of main equipment/plant under the Contract or 2 months from the date of Completion of Facilities whichever is earlier. 'Commercial Operation' shall mean the conditions of operation in which the complete equipment covered under the Contract is officially declared by the Employer to be available for continuous operation at different loads up to and including rated capacity. Such declaration by the Employer, however, shall</p>

Clause No.			GENERAL CONDITIONS OF CONTRACT (GCC)
			<p>not relieve or prejudice the Contractor any of his obligations under the Contract. In case of any failure in the original component/ equipment due to faulty designs, materials and workmanship, the corresponding spare parts, if any, supplied will be replaced without any extra cost to the Employer unless a joint examination and analysis by the Employer and the Contractor of such spare parts prove that the defect found in the original part that failed, can safely be assumed not to be present in spare parts. Such replaced spare parts will have the same Defect Liability as applicable to the replacement made for the defective original part/component provided that such replacement for the original equipment and the spare replaced are again manufactured together. The discarded spare parts will become the property of the Contractor as soon as they have been replaced by the Contractor.</p> <p>b) For the item of spares ordered or to be ordered by the Employer for 3 years operational requirement of the plant, which with the written approval of the Employer, are not manufactured as a continuous operation will be warranted for 7000 hrs of trouble free operation if used within a period of eighteen (18) months reckoned from the date of delivery at site. However, if such spare parts are put to use after eighteen (18) months of the delivery at Site then the guarantee of such spares will stand valid till the expiry of thirty six (36) months from the scheduled date of Commissioning of equipment/plant covered under the contract or 7000 hrs of trouble free operation after such spares are put in service, whichever is earlier.</p> <p>(ii) For long term requirement</p> <p>For item of spares that may be ordered by the Employer to cover requirements beyond 3 years of Initial Operation of the plant, the warranty will be till the expiry of 7000 hrs of trouble free operation if used within a period of eighteen (18) months from the date of delivery at site. For item of spares that may be used after eighteen (18) months from the date of delivery at site, the warranty period will be 12 months from the date they are put to use or 7000 hrs of trouble free operation, whichever is earlier. In any case the defect liability of spares will expire at the end of forty eight (48) months from the date of their receipt at site.</p> <p>(iii) The Defect Liability of spares covered in para (i) & (ii) above, that are not used within 18 months from the respective date of the delivery at Site will, however, be subject to condition that all such spares being stored/ maintained/ preserved in accordance with Contractor's standard recommended practice, if any, and the same has been furnished to the Employer.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
8.	Time for Commencement and Completion		
	8.1	The Contractor shall commence work on the Facilities from the date of Notification of Award and without prejudice to GCC Sub-Clause 26.2 hereof, the Contractor shall thereafter proceed with the Facilities in accordance with the time schedule specified in Appendix 4 (Time Schedule) to the Contract Agreement.	
	8.2	The Contractor shall attain Completion of the Facilities (or of a part where a separate time for Completion of such part is specified in the Contract) within the time stated in the SCC or within such extended time to which the Contractor shall be entitled under GCC Clause 40 (Extension of Time for Completion) hereof.	
9.	Contractor's Responsibilities		
	9.1	The Contractor shall design, manufacture (including associated purchases and/or subcontracting), install and complete the Facilities with due care and diligence in accordance with the Contract.	
	9.2	The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site (if access thereto was available) and of other data readily available to it relating to the Facilities as at the date fifteen (15) days prior to deadline set for price bid submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.	
	9.3	The Contractor shall acquire in its name all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located that are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 10.3 hereof and that are necessary for the performance of the Contract.	
	9.4	The Contractor shall comply with all laws in force in the country where the Facilities are installed and where the Installation Services are carried out. The laws will include all national, provincial, municipal or other laws that affect the performance of the Contract and bind upon the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties and expenses of whatever nature arising or resulting from the violation of such laws by the Contractor or its personnel, including the Subcontractors and their personnel, but without prejudice to GCC Sub-Clause 10.1 hereof.	
	9.5	Any Plant, Material and Services that will be incorporated in or be required for the Facilities and other supplies shall have their origin as specified under GCC Clause 3.13 (Country of Origin).	

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
10.	Employer's Responsibilities		
	10.1	The Employer shall ensure the accuracy of all information and/or data to be supplied by the Employer as described in Appendix 6 (Scope of Works and Supply by the Employer) to the Contract, except when otherwise expressly stated in the Contract.	
	10.2	<p>The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in Appendix 6 (Scope of Works and Supply by the Employer) to the Contract Agreement. The Employer shall give full possession of, and accord all rights of access thereto on or before the date(s) specified in Appendix 6.</p> <p>The Employer reserves the right to hand over the Site in parts progressively to the Contractor. The Contractor will be required to take possession of the Site without any undue delay and do work on the released fronts in parts without any reservation whatsoever.</p>	
	10.3	The Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which such authorities or undertakings require the Employer to obtain them in the Employer's name, are necessary for the execution of the Contract (they include those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract), including those specified in Appendix 6 (Scope of Works and Supply by the Employer) to the Contract Agreement.	
	10.4	If requested by the Contractor, the Employer shall use its best endeavours to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain.	
	10.5	Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities ; and shall perform all work and services of whatsoever nature, to enable the Contractor to properly carry out Pre-commissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of Appendix 6 (Scope of Works and Supply by the Employer) to the Contract Agreement at or before the time specified in the program furnished by the Contractor under GCC Sub-Clause 18.2 (Program of Performance) hereof and in the manner thereupon specified or as otherwise agreed upon by the Employer and the Contractor.	
	10.6	The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Sub-Clause 24.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Sub-Clause 25.2.	

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
		10.7	All costs and expenses involved in the performance of the obligations under this GCC Clause 10 shall be the responsibility of the Employer, save those to be incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Sub-Clause 25.2.
C. Payment			
11.	Contract Price		
		11.1	The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Form of Contract Agreement.
		11.2	The Contract Price shall be adjusted in accordance with provisions of Appendix-2 (Price Adjustment) to the Contract Agreement.
		11.3	Subject to GCC Sub-Clauses 9.2, 10.1 and 35 (Unforeseen Conditions) hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.
12.	Terms of Payment		
		12.1	The Contract Price shall be paid as specified in Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement. The procedures to be followed in making application for and processing payments shall be those outlined in the same Appendix 1.
		12.2	No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.
		12.3	The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's bid.
		12.4	<p>For payments related to Erection / Civil / Site Fabricated Structural works:</p> <p>A single designated ESCROW account shall be opened by the Contractor in any Scheduled Bank of India under intimation to Employer. All payments related to Erection / Civil / Site Fabricated Structural works by the Employer due under the contract to the Contractor shall be released into above-mentioned ESCROW account set up as per the Tri-Partite Escrow Agreement between Employer, Contractor and Escrow Bank. The payment shall be disbursed in accordance with the mechanism set out in the Contract and Escrow Agreement. The purpose of the Escrow Account would be to ensure that payments received under the contract are solely used for implementation of the Contract. Under Tripartite Escrow Agreement, the Escrow Bank will agree to ensure that amounts received in the ESCROW Account are utilized for making payments only to suppliers of goods and services, statutory authorities, establishment expenses etc. as may be required in the performance of the contract.</p> <p>All expenses/charges for opening /operation (including Annual Fee) of the Escrow Account shall be paid by the Contractor.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>The draft agreement is annexed as Annexure-III to Appendix-1 to Form of Contract Agreement, Section-VII, Book 3 of 3 (Part-1), which shall be followed for executing Escrow Account Agreement.</p> <p>The Detailed Operative Procedure and Terms and Conditions of Escrow Account (Schedule III of draft agreement) shall be finalized between the Employer, Contractor and the Escrow Bank within 15 days of the placement of award.</p>
13.	Securities		
		13.1	<p>Issuance of Securities</p> <p>The Contractor shall provide the securities specified below in favour of the Employer at the times, and in the amount, manner and form specified below.</p>
		13.2	<p>Advance Payment Security</p> <p>13.2.1 The Contractor shall, within twenty-eight (28) days of the Notification of Award of Contract, provide a security in an amount equal to the advance payment for supply of Plant & Equipment and 110% of the advance amount for Installation Services and Civil & Allied Works calculated in accordance with Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement, and in the currency or currencies of the Contract, with an initial validity of up to ninety (90) days beyond the schedule date of Completion of the last facility covered under the package in accordance with GCC Clause 24. However, in case of delay in completion of the facilities under the package, the validity of this security shall be extended by the period of such delay. The advance payment security shall also cover the amount of GST as applicable on the advance payment to be paid to the contractor.</p> <p>13.2.2 The security shall be in the form of an unconditional bank guarantee as per the proforma provided in Section VII (Forms and Procedures)- Form of Advance Payment Security. The Advance payment Security shall be reduced pro-rata every three (3) months after First Running Account Bill/Stage Payment under the Contract based on the value of the respective equipment/facilities received and applicable GST. The cumulative amount of reduction at any point of time shall not exceed ninety (90%) of the advance and the amount of GST paid on the advance amount corresponding to cumulative value of the respective equipment/Facilities supplied and received as per certificate issued by the Project Manager. The balance shall be released upon release of respective milestone linked payments as identified in Appendix-1 of form of Contract Agreement. In case milestone payment is not envisaged in the package, the balance shall be released after Completion of those Facilities on certification by the Project Manager. It should be clearly understood that reduction in the value of security for advance shall not in any way dilute the Contractor's responsibility and liabilities under the Contract including in respect of the Facilities for which the reduction in the value of security is allowed.</p>
		13.3	<p>Performance Security</p> <p>13.3.1 The Contractor shall, within twenty-eight (28) days of the Notification of Award, provide a security for the due performance</p>

Clause No.	GENERAL CONDITIONS OF CONTRACT (GCC)
	<p>of the Contract for ten percent (10%) of the Contract Price with an initial validity upto ninety (90) days beyond the Defects Liability Period. If the Employer enters into the Contract with the Assignee of a foreign Contractor pursuant to GCC Sub Clause 3.6, the said Assignee, in addition to the Contract Performance Security to be provided by the Contractor for ten percent (10%) of the value of all the Contracts shall provide within twenty eight (28) days of the Notification of Award, a separate Contract Performance Security equivalent to ten percent (10%) of the value of Contract entered into with the assignee, for the due performance of Contract with an initial validity upto Ninety (90) days beyond the Defects Liability Period. However, in case of delay in completion of the Defect Liability Period, the validity of all the Contract Performance Securities shall be extended by the Period of such delay correspondingly.</p> <p>Security as mentioned above shall remain non-negotiable during the performance of the contract.</p> <p>13.3.2 The performance security shall be denominated in the currency of the Contract and shall be in the form of unconditional bank guarantee provided in Section-VII (Forms and Procedures)-Form of Performance Security of the bidding documents.</p> <p>13.3.3 Unless otherwise stipulated in SCC, the security shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate time for Completion is provided, twenty one (21) months after Completion of the Facilities or where relevant part thereof, or fifteen (15) months after Operational Acceptance of the Facilities (or the relevant part thereof), whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 27.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 27.10, is liable for an extended warranty obligation, the performance security shall be extended for the period and up to the amount agreed upon or as specified in the SCC.</p> <p>13.3.4 Whenever adjustments under Clause 39 [Change in the Facilities] result in an accumulative increase or decrease of the Contract Price by more than fifteen percent (15%) of the Contract Price stated in the Contract Agreement:</p> <p>(a) in the case of such an increase, at the Project Manager's request the Contractor shall promptly increase the amount of the Performance Security in that currency by a percentage equal to the accumulative increase; or</p> <p>(b) in the case of such a decrease, subject to the Project Manager's prior consent the Contractor may decrease the amount of the Performance Security in that currency by a percentage equal to the accumulative decrease.</p> <p>Security for Deed of Joint Undertaking</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
	13.4	<p>In case Deed(s) of Joint Undertaking by the Contractor along with his Collaborator(s) / Associate(s) form part of the Contract, then, in addition to the Contract performance securities furnished by the Contractor, the Collaborator(s) / Associate(s) shall furnish, within twenty eight (28) days of the Notification of Award, separate unconditional Bank Guarantee(s)/Insurance surety Bond(s) towards faithful performance of the Deed(s) of Joint Undertaking for amount(s) specified in relevant Item of Bid Data Sheets and with validity till such period as specified in the corresponding format for Deed of Joint Undertaking. However, in case of delay in completion of defect liability period, the validity of Bank Guarantee(s) /Insurance surety Bond(s) submitted towards faithful performance of Deed(s) of Joint Undertaking shall be extended by such period of delay.</p> <p>The Bank Guarantee(s) /Insurance surety Bond(s) shall be denominated in the currency or currencies of Contract and shall be as per the proforma provided in Section-VII (Forms and Procedures) - Form of Bank Guarantee to be furnished by Associate(s) / Collaborator(s).</p>
	13.5	<p>The Bank Guarantees submitted towards Advance Payment Security, Contract Performance Security and Security in compliance to the Deed of Joint Undertaking (if applicable) shall be essentially from any of the Banks listed at Annexure-I to Section-V (Special Conditions of Contract) of the bidding documents.</p> <p>In case of guarantees issued by branches outside India for foreign banks, the bank guarantees shall be routed through the correspondent Bank in India for due verification of signatures of the executant and lodgement of claim.</p> <p>The bank guarantee submitted from within India towards Advance Payment Security, Contract Performance Security and Security for Deed of Joint Undertaking (if applicable) shall be issued on a stamp paper of appropriate value as per stamp act prevailing in the State of the issuing Bank in India or the state of U.P. in India or the State from where the BG shall be operated, whichever is higher.</p>
	13.6	<p>Where a BG issued by a Bank outside India also needs to bear Stamp Duty of appropriate value applicable to the place in NTPC / Employer where BG is to be submitted, the BG will be adjudicated from Collector of Stamps, within 3 months of arrival of BG in India and the expenses incurred in this regard shall be borne by the Contractor.</p>
	13.7	<p>a) All BGs except BG issued by a Bank outside India and all Insurance Surety Bonds except those issued by an Indian Insurance company outside India , shall be received from issuing Bank/Insurance company directly through post/ courier, to the employers address.</p> <p>A BG issued by a Bank outside India and Insurance Surety Bond issued by an Indian Insurance company outside India need to be submitted by the Bidder directly to the employer as defined in BDS. The BG/ Insurance Surety Bond also needs to bear stamp duty of appropriate value applicable to the place in NTPC/NVVN where BG/ Insurance Surety Bond is to be submitted. The BG/ Insurance Surety Bond may be got adjudicated by the employer from Collector of Stamps, within 3 months of arrival of BG/</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>Insurance Surety Bond in India. Expenses incurred in this regard shall be adjusted from the payment due to the contractor.</p> <p>b) A soft copy of the BG/ Insurance Surety Bond is mandatorily required to be mailed to nvvncontracts@ntpc.co.in by the issuing Bank/ Insurance company.</p> <p>c) Confirmation of BGs through Structured Financial Messaging System (SFMS)/SWIFT</p> <p>While issuing the physical BGs, the Bidder's Bank shall also send electronic message through secure SFMS (in case of BGs issued from within India) or SWIFT (in case of BGs issued from outside India) to Employer's Beneficiary Bank whose details are provided herein below:</p> <p>(i) Bank Name: ICICI Bank Limited (ii) Branch: CONNAUGHT PLACE BRANCH (iii) Bank Address: 9A, PHELPS BUILDING, INNER CIRCLE, NEW DELHI- 110001 (iv) IFSC Code: ICIC0000007</p> <p>BG issuing/amending bank must send the BG advice in the form of message format via SFMS (Structured Financial Messaging System) as provided by RBI. The format of the message for confirmation of the BG shall be as below:</p> <p>BG advising message: IFN 760COV/ IFN 767COV via SFMS Field Number: Particulars (to be mentioned in Row 1) 7037: NVVNBG8910 (unique identifier)</p> <p>d) All Bank Guarantees/ Insurance Surety Bond should be enforceable for minimum ninety (90 days) after expiry of its validity.</p> <p>e) Extension of all BGs/ Insurance Surety Bonds should be on Stamp paper of same value as that of the original BG/ Insurance Surety Bond. Minimum extension of any BG/ Insurance Surety Bond should be three months.</p>
14.	Taxes and Duties		
	14.1	<p>Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges assessed on the Contractor, its Sub-contractor or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.</p>	

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
	14.2	<p>Notwithstanding GCC Sub-Clauses 14.1 above, the Employer shall bear and promptly pay/reimburse all Customs and Import duties (including GST), on the Plant and Equipment including Mandatory Spares supplied from abroad and specified in Price Schedule No. 1 (and on Recommended Spare Parts to be supplied from abroad and specified in Price Schedule No. 6, when awarded) and that are to be incorporated into the Facilities, by the law of the country where the Site is located. However, if the Plant and Equipment are shipped in Shipper's containers, then the custom duty, GST and any other Tax, duty, levy or cess levied on the cost of empty containers shall be borne and paid/reimbursed by the Contractor. Further, Anti-dumping duty, Counter-vailing duty on subsidised articles, Safeguard duty etc. and any other tax including GST, levies, cess etc. applicable on such additional duties, if imposed on Plant and Equipment including Type Test and Mandatory Spares/ Recommended Spares, shall be borne by the Contractor.</p> <p>If the liability/ payment on account of Customs Duty/ import duty and GST on CIF price (Schedule-1) exceeds the amount quoted by the bidder in schedule-7A, at any time during the performance of the contract, such excess shall be recovered from the Contractor.</p> <p>Notwithstanding the foregoing, if, after the date seven (7) days prior to the deadline set for Price Bid submission, the relevant Customs Acts & Notification of Govt. of India is abrogated or changed (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently increases the taxes & duties quoted by the bidder in Schedule-7A, any such increase in taxes & duties shall be to the account of Employer.</p> <p>The Employer shall also bear and pay/reimburse to the Contractor Goods and Services Tax (GST) applicable on: (a) Plant and Equipment (including Type Test Charges) and Mandatory Spares to be supplied from within the Employer's country specified in Price Schedule No. 2 (and also on locally supplied Recommended Spare Parts quoted in Price Schedule No. 6, when awarded) to be incorporated in the Facilities, by the law of country where the site is located, (b) local transportation & insurance, other local costs incidental to delivery of plant & equipment including mandatory spares specified in Price Schedule No. 3 (and also of locally supplied Recommended Spare Parts quoted in Price Schedule No. 6, when awarded) and (c) Installation Services including Erection, Civil & Allied Works and other services specified in Price Schedule No. 4. However, all other taxes, duties & levies as may be applicable on goods and services specified in Price Schedules Nos. 2, 3 & 4 and on the materials used for civil construction works and erection & commissioning shall be to the contractor's account and no separate claim in this regard will be entertained by the Employer.</p> <p>For the above purpose, price components of Schedule-2 & Schedule-4, if quoted in foreign currency and so incorporated in the contract, shall be converted to Indian Rupees as per the exchange rate determined by relevant GST notifications / rules prevailing on the date and time of supply of goods and services.</p> <p>Notwithstanding anything to contrary contained in the Contract, the Contractor's right to payment under the Contract is subject to issuance of valid tax invoice, payment of applicable GST to the credit of appropriate Government and submission of valid particulars of tax invoice under GST returns in accordance with GST Law.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>The Contractor shall issue tax invoices, file appropriate returns, and deposit the applicable GST to the account of appropriate government within the time limit prescribed under the GST Law. In the event of any default, Contractor shall be liable to pay any penalty/demand raised on the Employer due to default by Contractor, and the same shall be recovered/Contractor shall make good the loss.</p> <p>The Contractor shall be responsible for the issuance of e-way bill and other compliances relating to e-way bill as per GST law.</p> <p>The Employer will deduct GST at source at the applicable rates in case transactions under the contract are liable to GST deduction at source as per the prevailing provisions of GST Law.</p>
		14.3	If any tax exemptions, reductions, allowances or privileges are available to the Contractor in the country where the Site is located, the Employer shall use its best endeavours to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
		14.4	<p>For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies and charges prevailing on seven (7) days prior to the deadline set for price bid submission in the country where the Site is located (hereinafter called "Tax" in this GCC Sub-Clause 14.4). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of Contract, which was or will be assessed on the Contractor in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction therefrom, as the case may be, in accordance with GCC Clause 36 (Change in Laws and Regulations) hereof. However, these adjustments shall not be applicable on procurement of raw materials, intermediary components and intermediary services etc. by the Contractor.</p> <p>Income Tax:</p> <p>As per Indian Income Tax Act & Rules, Employer is required to deduct Income Tax at source from all the payments to be made to Non-resident/Foreign Contractor. For this purpose, the Contractor shall be required to either furnish (i) the certificate from Indian Tax Authority or (ii) Ruling from "the Authority for Advance Ruling (AAR)" determining the applicable rate of Income tax in India before release of first payment.</p>
		14.5	If the Employer orders any spare at a later date as per GCC CI 7.3, all applicable additional taxes & duties, If any, not included in the original price shall be to the account of Employer.
		14.6	The Contractor will be required to submit PAN details to the Project Manager before the submission of the first bill.
D. Intellectual Property			
15.	Copyright		
		15.1	The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			Employer directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party. The Employer shall however be free to reproduce and use all drawings, documents and other material furnished to the Employer for the purpose of the contract, if required, for operation and maintenance and Renovation & Modernization of the Facilities (Throughout actual or intended life of facility whichever is longer).
16.	Confidential Information		
		16.1	The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16.
		16.2	The Employer shall not use such documents, data and other information received from the Contractor for any purpose other than the operation and maintenance and Renovation & Modernization and demolishing the work (Throughout actual or intended life of facility whichever is longer). Similarly, the Contractor shall not use such documents, data and other information received from the Employer for any purpose other than the design, procurement of Plant and Equipments, construction or such other work and services as are required for the performance of the Contract.
		16.3	The obligation of a party under GCC Sub-Clauses 16.1 and 16.2 above, however, shall not apply to that information which <ul style="list-style-type: none"> (a) now or hereafter enters the public domain through no fault of that party (b) can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto (c) otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality. (d) is required to be disclosed in accordance with a judicial or governmental order or decree.
		16.4	The above provisions of this GCC Clause 16 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.
		16.5	The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.
			E. Work Execution
17.	Representatives		

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
	17.1	<p>Project Manager</p> <p>If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. The Employer shall take reasonable care to see that no such appointment is made at such a time or in such a manner as to impede the progress of work on the Facilities. The Project Manager shall represent and act for the Employer at all times during the currency of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided. Omission by the Employer or Project Manager, as the case may be, to respond to any communication including letters of or on behalf of the Contractor to either or both of them shall not be deemed or construed as admission by the Employer or the Project Manager of the contents thereof, except as otherwise provided for in the contract.</p> <p>All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided.</p>
	17.2	<p>Contractor's Representative & Construction Manager</p>
	17.2.1	<p>The Contractor shall appoint the Contractor's Representative within fourteen (14) days of the Effective Date or before start of work whichever is earlier and shall request the Employer in writing to approve the person so appointed.</p> <p>17.2.1.1 The Contractor's representative shall be a regular Employee/ Partner/ Director only and the Contractor shall be required to submit a Power of Attorney in original in favour of its representative. Notarized photocopy of the Power of Attorney shall be acceptable only if the Power of Attorney has been registered by the Contractor. The Employer may verify the photocopy of the Power of Attorney with the Original and the Contractor shall be required to produce the original Power of Attorney for verification, if required by the Employer. The relation of the Contractor's representative with the contractor such as Partner/ Employee etc. should be clearly brought out in the Power of Attorney. The Contractor would be required to submit a documentary proof of the relation of the Contractor's representative with the contractor in the form of self-attested copy of any of the following documents:</p> <p>i. Previous financial year's Form 16 as available at TRACES site of Income tax department, if the Contractor's representative is an employee of contractor or his Appointment Letter/ Salary Slip/ other documentary evidence (only in case of recent appointment or where Form 16 details are not uploaded at TRACES). Further, the Contractor shall submit the copy of Form 16 as available through TRACES site for every subsequent year also in respect of the Contractor's representative till the period of authorization.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>ii. Article of Association/ Registered Partnership Deed if the Contractor's representative is a partner or stake holder in Company.</p> <p>In case, the Contractor is not able to submit any of the documentary proofs as mentioned above at para (i) & (ii), he would be required to submit an affidavit stating the relationship between the Contractor's representative and the Contractor.</p> <p>17.2.1.2 In case, the Contractor's representative is also doing some other Contract(s)/ Work(s) as nominee of the same contractor, the Contractor shall give a declaration citing list of all works where the Contractor's representative is the nominee.</p> <p>17.2.1.3 If the Employer objects to the appointment giving the reason therefore, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 17.2.1 shall apply thereto.</p>
		<p>17.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the currency of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract.</p> <p>All notices, instructions, information and all other communications given by the Employer or the Project Manager to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.</p> <p>The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 17.2.1.</p> <p>17.2.3 The Contractor's Representative may, subject to the approval of the Employer (which shall not be unreasonably withheld), at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager.</p> <p>Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 17.2.3 shall be deemed to be an act or exercise by the Contractor's Representative. For avoidance of doubt it is expressly agreed that no such delegation etc shall effect or relieve the Contractor in any manner whatsoever of its obligations and liabilities under the Contract.</p>

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			<p>17.2.3.1 Notwithstanding anything stated in GCC Sub-clause 17.1 and 17.2.1 above, for the purpose of execution of contract, the Employer and the Contractor shall finalise and agree to a Contract Co-ordination Procedure and all the communication under the Contract shall be in accordance with such Contract Co-ordination Procedure.</p> <p>17.2.4 From the commencement of installation of the Facilities at the Site until Operational Acceptance, the Contractor's Representative shall appoint a suitable person as the construction manager (hereinafter referred to as "the Construction Manager"). The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as his or her deputy.</p> <p>17.2.5 The Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Sub-Clause 22.3. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.</p> <p>17.2.6 If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 17.2.5, the Contractor shall, where required, promptly appoint a replacement.</p> <p>17.2.7 In case any of the information/ declaration/ undertaking provided by Contractor/Contractor's representative is found to be false and/ or the Contractor/ Contractor's representative suppresses any relevant information at any stage, the Contractor will be liable for actions in terms of Employer's Debarment policy.</p>
18.	Work Program		
	18.1	<p>Contractor's Organization</p> <p>The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities. The chart shall include the identities of the key personnel together with the curricula vitae of such key personnel to be employed within twenty-one (21) days of the Effective Date. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.</p>	
	18.2	<p>Program of Performance</p> <p>Within twenty-eight (28) days after the date of notification of award of Contract, the Contractor shall prepare and submit to the Project Manager a detailed program of performance of the Contract, made in the form of PERT Network and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and pre-commission the</p>	

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			Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in Appendix 4 (Time Schedule) to the Contract Agreement and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion given in the SCC and any extension granted in accordance with GCC Clause 40, and shall submit all such revisions to the Project Manager.
		18.3	<p>Progress Report</p> <p>The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 18.2 (Program of Performance) above, and submit a progress report to the Project Manager every month.</p> <p>The progress report shall be in a form acceptable to the Project Manager and shall also indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.</p>
		18.4	<p>Progress of Performance</p> <p>If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 18.2 (Program of Performance), or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 8.2 (Time for Commencement and Completion), any extension thereof entitled under GCC Sub-Clause 40.1 (Extension of Time for Completion), or any extended period as may otherwise be agreed upon between the Employer and the Contractor.</p>
		18.5	<p>Work Procedures</p> <p>The Contract shall be executed in accordance with the Contract Documents and the procedures given in the section on Forms and Procedures of the Contract Documents.</p> <p>If agreed between the Employer and the Contractor, the Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.</p>

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		18.6	<p>Maintenance of Records of Weekly Progress Review Meetings at site</p> <p>The Contractor shall be required to attend all weekly site progress review meetings organized by the 'Project Manager' or his authorized representative. The deliberations in the meetings shall inter alia include the weekly program, progress of work (including details of manpower, tools and plants deployed by the contractor vis-a-vis agreed schedule), inputs to be provided by Employer, delays, if any, and recovery program, specific hindrances to work and work instructions by Employer. Record of Hindrances / events that lead to slow/ stoppage of smooth execution of work shall be maintained in "Hindrance Register". The minutes of the weekly meetings shall be recorded in triplicate in a numbered register available with the 'Project Manager', or his authorized representative. These recordings shall be jointly signed by the Project Manager or his authorized representative and the Contractor and one copy of the signed records shall be handed over to the Contractor.</p>
19.	Subcontracting		
		19.1	<p>Appendix 5 (List of Approved Subcontractors) to the Contract Agreement specifies major items of supply or services and a list of approved Subcontractors against each item, including vendors. Insofar as no Subcontractors are listed against any such item, the Contractor shall prepare a list of Subcontractors for such item for inclusion in such list. The Contractor may from time to time propose any addition to or deletion from any such list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties or responsibilities under the Contract.</p>
		19.2	<p>The Contractor shall select and employ its Subcontractors for such major items from those listed in the lists referred to in GCC Sub-Clause 19.1.</p>
		19.3	<p>For items or parts of the Facilities not specified in Appendix 5 (List of Approved Subcontractors) to the Contract Agreement, the Contractor may employ such Subcontractors as it may select, at its discretion.</p>
		19.4	<p>The Contractor shall not be allowed to sub-contract works to any subcontractor/ sub-vendor from a country which shares a land border with India unless such subcontractor is registered with the competent Authority.</p> <p>The Competent Authority for the purpose of registration shall be as mentioned in the relevant Annexure of SCC.</p> <p>However, the said requirement of registration will not apply to subcontractors from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects. The Contractor may apprise itself of the updated lists of such countries available in the website of the Ministry of External Affairs.</p> <p>Procurement of raw material, components, etc. for the purposes of performance of the Contractor's obligation under the Contract shall not constitute subcontracting.</p>

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	19.5	<p>Sub-contractor/Sub-vendor Management</p> <p>In the event of failure to commence work or achieve the desired work progress as per the Program of Performance because of non-payment to any Sub-contractor/ Sub-vendor by the Contractor, Employer may issue notice as set forth herein in respect thereof to the Contractor. Even after serving two notices with notice period of 14 days & 7 days, if Contractor fails to commence the work /restore the progress of work by making the payment to such Sub-contractor/ Sub-vendor, the Contractor hereby expressly consents to the Employer for making direct payment in the name and on behalf and to the account of the Contractor to such Sub-contractor/ Sub-vendor from the payments due to the Contractor under the Contract or in order to commence / restore the progress of the work. No such payment by the Employer in the name and behalf and to the account of the Contractor shall constitute or be construed as any privity of contract of such Sub-contractor/ Sub-vendor with the Employer and such Sub-contractor/ Sub-vendor shall continue to be Sub-contractor/ Sub-vendor of Contractor and the Contractor shall continue to be responsible and liable to the Employer for all the obligations including but not limited to Performance Guarantees and Warrantees under the Contract and the work of such Sub-contractor/ Sub-vendor.</p>	
	19.6	<p>For the purpose of Integrity Pact, "Subcontractor" shall mean only the approved Subcontractor by the Employer for specific Work(s) at Site.</p> <p>The Contractor shall not be allowed to sub-contract Work(s) to any subcontractor listed in Appendix 5 (List of Approved Subcontractors) or for which approval by Employer is required, as per GCC sub-clause 19.1, unless such sub-contractor has agreed to abide by and sign the Integrity Pact before start of work by respective sub-contractor.</p> <p>The Contractor shall ensure that all the sub-contractors sign the Integrity pact executed between the Employer & Contractor, before start of work by respective sub-contractor at Site.</p> <p>Further, the Contractor shall submit a copy of the aforesaid Integrity Pact duly signed by the approved sub-contractor, to Project Manager, prior to commencement of work.</p>	
20.	Design And Engineering		
	20.1	<p>Specifications and Drawings</p> <p>20.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice.</p> <p>The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.</p> <p>20.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the</p>	

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			Employer, by giving a notice of such disclaimer to the Project Manager.
		20.2	<p>Codes and Standards</p> <p>Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date fifteen (15) days prior to deadline set for price bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied after approval by the Employer and shall be treated in accordance with GCC Clause 39 (Changes Originating from Contractor).</p>
		20.3	<p>Approval/Review of Technical Documents by Project Manager</p> <p>20.3.1 The Contractor shall prepare (or cause its Subcontractors to prepare) and furnish to the Project Manager the documents listed in Appendix 7 (List of Documents for Approval or Review) to the Contract Agreement for its approval or review as specified and as in accordance with the requirements of GCC Sub-Clause 18.2 (Program of Performance).</p> <p>Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.</p> <p>GCC Sub-Clauses 20.3.2 through 20.3.7 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only.</p> <p>20.3.2 Within twenty one (21) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes.</p> <p>20.3.3 The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with some specified provision of the Contract or that it is contrary to good engineering practice.</p> <p>20.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub-Clause 20.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), and upon resubmission with the required modifications the document shall be deemed to have been approved.</p> <p>The procedure for submission of the documents by the Contractor and their approval by the Project Manager shall be discussed and finalised with the Contractor.</p> <p>20.3.5 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by</p>

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			<p>the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be referred to Expert Settlement Council (ESC) for determination in accordance with GCC Sub-Clause 6.4.1 hereof. If such dispute or difference is referred to ESC, the Project Manager shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the ESC upholds the Contractor's view on the dispute and if the Employer has not given notice under GCC Sub-Clause 6.5.1 hereof, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the ESC shall decide, and the Time for Completion shall be extended accordingly.</p> <p>20.3.6 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.</p> <p>20.3.7 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Sub-Clause 20.3.</p> <p>If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 39 (Change in the Facilities) shall apply to such request.</p>
21.	Procurement		
	21.1	Plant and Equipment	
		Subject to GCC Sub-Clause 14.2, the Contractor shall manufacture or procure and transport all the Plant and Equipment in an expeditious and orderly manner to the Site.	
	21.2	Employer-Supplied Plant, Equipment, and Materials	
		<p>If Appendix 6 (Scope of Works and Supply by the Employer) to the Contract Agreement provides that the Employer shall furnish any specific items of machinery, equipment or materials to the Contractor, the following provisions shall apply:</p> <p>21.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Sub-Clause 18.2 (Program of Performance), unless otherwise mutually agreed.</p>	

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		<p>21.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect or default. The Employer shall immediately remedy any shortage, defect or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody and control of the Contractor. The provision of this GCC Sub-Clause 21.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired.</p> <p>21.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody and control shall not relieve the Employer of liability for any undetected shortage, defect or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 27 (Defect Liability) or under any other provision of Contract.</p>
	21.3	<p>Transportation</p> <p>21.3.1 The Contractor shall at its own risk and expense transport all the Plant and Equipment and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances.</p> <p>Packing Material</p> <p>The Contractor shall ensure that all the plant and equipment are suitably packed and protected to prevent damage or deterioration during its transportation to site, handling and storage at site till the time of its installation. The ownership of all such packing material (except empty shipper's containers on which the customs duty has been paid by the Contractor pursuant to GCC Clause 14.2) shall stand transferred to the Employer upon dispatch of the plant and equipment and endorsement of dispatch documents in favour of the Employer.</p> <p>21.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the Plant and Equipment and the Contractor's Equipment.</p> <p>In case, the Contractor decides to transport the Plant and Equipment and the Contractor's Equipment by road, then such Plant and Equipment and the Contractor's Equipment must necessarily be transported through a registered common carrier as per Carriage by Road Rules 2011 of Central Government of India.</p> <p>21.3.3 Upon despatch of each shipment of the Plant and Equipment and the Contractor's Equipment, the Contractor shall notify the Employer of the description of the Plant and Equipment and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor</p>

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			<p>shall furnish the Employer with relevant shipping documents to be agreed upon between the parties.</p> <p>21.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the Plant and Equipment and the Contractor's Equipment to the Site. The Employer shall use its best endeavours in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the Plant and Equipment and the Contractor's Equipment to the Site.</p> <p>21.4 Customs Clearance</p> <p>The Contractor shall, at its own expense, handle all imported Plant and Equipments and spares and Contractor's Equipments at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Sub Clause 14.2, provided that if applicable laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance due to fault of the Employer, the Contractor shall be entitled to an Extension in the Time for Completion, pursuant to GCC Clause 40.</p>
22.	Installation		
		22.1	<p>Setting Out/Supervision/Labour</p> <p>22.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks and lines provided to it in writing by or on behalf of the Employer.</p> <p>If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer.</p> <p>22.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.</p> <p>22.1.3 Labour:</p>

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			<p>(a) The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely execution of the Contract. The Contractor shall preferably engage skilled/ semiskilled/ unskilled workers from amongst the land oustees of the Project.</p> <p>(b) Unless otherwise provided in the Contract, the Contractor shall be responsible for the recruitment, transportation, accommodation and catering of all labour, local or expatriate, required for the execution of the Contract and for all payments in connection therewith.</p> <p>(c) The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labour and personnel to be employed on the Site into the country where the Site is located.</p> <p>(d) The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to their various home countries. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.</p> <p>(e) The Contractor shall at all times during the progress of the Contract use its best endeavour to prevent any unlawful, riotous or disorderly conduct or behaviour by or amongst its employees and the labour of its Subcontractors.</p> <p>(f) The Contractor shall, in all dealings with its labour and the labour of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labour.</p>
		22.2	<p>Contractor's Equipment</p> <p>22.2.1 All Contractors' Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.</p> <p>22.2.2 Unless otherwise specified in the Contract, upon Completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon.</p>

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		<p>22.2.3 The Employer will, if requested, use its best endeavour to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.</p>
	22.3	<p>Site Regulations and Safety</p> <p>22.3.1 The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld.</p> <p>Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities in line with para 22.3.2, gate control, sanitation, medical care, and fire prevention.</p> <p>22.3.2 The Employer has formulated Safety Rules for Construction & Erection of Power Plants and is enclosed at Annexure-B to GCC. These Safety Rules lay down the safety requirements for safe execution of project activities, responsibilities of the Contractor, and all concerned involved in Construction and Erection. The Contractor, including his sub-contractors, while executing the Works, shall strictly comply with these Safety rules and statutory requirements (including amendments thereof), as applicable, in respect of safety of personnel, equipment and materials at site area under execution of the Contractor.</p> <p>22.3.3 In addition to other clauses specified in 'NTPC Safety Rules for Construction and Erection of Power Plants' [as enclosed with GCC], Contractor shall adhere to the following provisions for payment linked to Safety Compliances as specified in Payment Terms:</p> <p>i) Safety Personnel</p> <p>Contractor shall adhere to the requirements of Clause 2.3 (requirement of Safety personnel) of 'NTPC Safety Rules for Construction and Erection of Power Plants'.</p> <p>ii) Personal Protective Equipment & Safety Equipment</p> <p>Contractor shall adhere to the requirements of Clause 4 (Personal Protective Equipment) of 'NTPC Safety Rules for Construction and Erection of Power Plants' and the provisions of the Bidding Documents with regards to number of Safety Equipment/PPEs to be provided by the Contractor.</p> <p>In case Contractor fails to comply with aforesaid requirement, Project Manager /Safety Officer shall issue a warning letter/Non-compliance Memo to the Contractor regarding the same advising him to take corrective action.</p>

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		<p>Project Manager /NTPC Safety Officer shall maintain written record of all such incidents when Warning letter/Non-compliance Memo is issued to the Contractor for not meeting the requirements of Clause 4.0 (Personal Protective Equipment) and the provisions of the Bidding Documents.</p> <p>iii) Safety Induction and Training</p> <p>Contractor shall adhere to the requirements of imparting Safety training as per Clause 8.0 (Safety Induction and Training) of 'NTPC Safety Rules for Construction and Erection of Power Plants.</p> <p>Contractor shall maintain written record of Safety trainings imparted to its Employees/ workmen for purpose of aforesaid payment. These records shall be available for review of Project Manager /NTPC Safety Officer all the time.</p> <p>iv) Medical and First Aid Amenities</p> <p>Contractor shall adhere to the requirements of Clause 13 (Medical and First Aid Amenities) of 'NTPC Safety Rules for Construction and Erection of Power Plants.</p> <p>NTPC Safety Officer/ Project Manager shall maintain written record of incidences when requisite Medical and first aid amenities as per Clause 13 of Safety Rules were not available for purpose of aforesaid payment.</p> <p>v) Compliance to Work Permit System</p> <p>Contractor shall adhere to the requirements of Clause 17 (Work Permit System) of 'NTPC Safety Rules for Construction and Erection of Power Plants'.</p> <p>In case Contractor fails to obtain work permit or fails to comply to any requirements of aforesaid Work permit system, he will be issued a warning letter/Non-compliance Memo by Project Manager /Safety Officer of NTPC regarding the same advising him to take corrective action.</p> <p>NTPC Safety Officer / Project Manager shall maintain written record of all such incidents when Warning letter / Non-compliance Memo is issued to Contractor for not complying with the requirements of Work Permit System as per Clause 17 of Safety Rules for purpose of aforesaid payment.</p>
	22.4	<p>Opportunities for Other Contractors</p> <p>22.4.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site.</p> <p>22.4.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Contractor reasonable remuneration for the use of such equipment or the provision of such services.</p> <p>22.4.3 The Contractor shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other contractors. The Project Manager shall determine the resolution of any difference or conflict that may arise between the Contractor and other contractors and the workers of the Employer in regard to their work.</p> <p>22.4.4 The Contractor shall notify the Project Manager promptly of any defects in the other Contractors' work that come to its notice, and that could affect the Contractor's work. The Project Manager shall determine the corrective measures, if any, required to rectify the situation after inspection of the Facilities. Decisions made by the Project Manager shall be binding on the Contractor.</p>
		22.5	<p>Emergency Work</p> <p>If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Contractor shall immediately carry out such work.</p> <p>If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.</p>
		22.6	<p>Site Clearance</p> <p>22.6.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract.</p> <p>22.6.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities clean and safe.</p> <p>22.6.3 Disposal of Scrap</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>The Contractor shall with the agreement of the Employer promptly remove from the site any 'Scrap' generated during performance of any activities at site in pursuance of the Contract. The term 'Scrap' shall refer to scrap/ waste/ remnants arising out of the fabrication of structural steel work and piping work at the project site in the course of execution of the contract and shall also include any wastage of cables during the termination process while installing the cables.</p> <p>The ownership of such Scrap shall vest with the Contractor except in cases where the items have been issued by the Employer from its stores for their installation only without any adjustment to the Contract Price. The removal of scrap shall be subject to the Contractor producing the necessary clearance from the relevant authorities (Custom, GST etc.), if required by the law, in respect of disposal of the scrap. The liability for the payment of the applicable taxes/duties shall be that of the Contractor.</p> <p>The Contractor shall also indemnify to keep the Employer harmless from any act of omission or negligence on the part of the Contractor in following the statutory requirements with regard to removal/disposal of scrap. The Indemnity-cum-Undertaking Agreement shall be furnished by Contractor as per proforma enclosed in Section-VII (Forms and Procedure). Further, in case the laws require the Employer to take prior permission of the relevant Authorities before handing over the scrap to the Contractor, the same shall be obtained by the Contractor on behalf of the Employer.</p>
		22.7	<p>Watching and Lighting</p> <p>The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.</p>
		22.8	<p>Shift Work</p> <p>22.8.1 To achieve the required rate of progress in order to complete the Facilities within the Time for Completion, the Contractor may carry on the work, round the clock, in multiple shifts per day, as may be necessary. The Contractor shall however be responsible to comply with all applicable laws in this regard.</p> <p>22.8.2 No additional payment will be made on account of round the clock working in multiple shifts.</p> <p>22.8.3 Wherever the work is carried out at night adequate lighting of working areas and access routes for pedestrians or vehicles shall be provided by the Contractor at his cost. Sufficient notice should be given by the Contractor to the Employer regarding the details of works in shifts so that necessary supervision could be provided.</p>
		22.9	<p>Civil work/structural work/ minor erection work at Risk & Cost of the Contractor</p> <p>Pursuant to GCC clause 18.4 regarding Progress of Performance and GCC clause 18.6 regarding Maintenance of Records of Weekly Progress</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>Review Meetings at site, in the event of failure of Contractor to achieve the desired Work Progress as per the Program of Performance (refer GCC clause 18.2) on account of civil work/structural work/ minor erection work, Employer, without prejudice to any other right under the Contract, has right to get such works done at the risk & cost of the Contractor with prior 14 days' notice to the Contractor and the same shall not relieve or absolve in any manner whatsoever the Contractor from any of its obligations including but not limited to Performance Guarantees and Warrantees under the Contract.</p> <p>If Employer gets such works done, the cost of getting such work done by the Employer shall be determined including Employer's pre-determined overhead (as specified in SCC) on the value executed at the risk & cost of the Contractor and shall be recovered from the Contractor.</p>
23.	Test And Inspection		
		23.1	The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and Equipment and any part of the Facilities as are specified in the Contract.
		23.2	The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all travelling and board and lodging expenses.
		23.3	Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager (or their designated representatives) to attend the test and/or inspection.
		23.4	<p>The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.</p> <p>If the Employer or Project Manager (or their designated representatives) fails to attend the test and/or inspection, or if it is agreed between the parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.</p>
		23.5	The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, where the purpose of these tests/ inspection is to verify compliance with the Technical Specifications and are feasible without creating a risk of damage to the Works, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impedes the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.
		23.6	If any Plant and Equipment or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			Plant and Equipment or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 23.3.
		23.7	If any dispute or difference of opinion shall arise between the parties in connection with or arising out of the test and/or inspection of the Plant and Equipment or part of the Facilities that cannot be settled between the parties within a reasonable period of time, it may be referred to the Expert Settlement Council (ESC) for determination in accordance with GCC Sub-Clause 6.4.1.
		23.8	The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant and Equipment are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice.
		23.9	The Contractor agrees that neither the execution of a test and/or inspection of Plant and Equipment or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 23.4, shall release the Contractor from any other responsibilities under the Contract.
		23.10	No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such part of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.
		23.11	The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts. If any part of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 23.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been delayed or impeded in the performance of any of its obligations under the Contract.
24.	Completion of the Facilities		
		24.1	As soon as installation of the Facilities or any part thereof has, in the opinion of the Contractor, been completed as specified in the Technical Specifications, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.
		24.2	Within seven (7) days after receipt of the notice from the Contractor under GCC Sub-Clause 24.1, the Employer shall supply the operating and maintenance personnel and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services as specified in Appendix 6 (Scope

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			of Works and Supply by the Employer) to the Contract Agreement, required for Pre-commissioning of the Facilities or any part thereof.
		24.3	As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters, if so specified in Appendix 6 (Scope of Works and Supply by the Employer)/ Technical Specifications, have been provided by the Employer in accordance with GCC Sub-Clause 24.2, the Contractor shall commence Pre-commissioning of the Facilities or the relevant part thereof in preparation for Commissioning.
		24.4	As soon as all works in respect of Pre-commissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready for Commissioning, the Contractor shall commence Commissioning as per procedures stipulated in Technical Specifications, and as soon as Commissioning is satisfactorily completed, the Contractor shall so notify the Project Manager in writing.
		24.5	<p>The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.4, either issue a Completion Certificate in the form specified in the Forms and Procedures section in the bidding documents, stating that the Facilities or that part thereof have reached Completion as at the date of the Contractor's notice under GCC Sub-Clause 24.4, or notify the Contractor in writing of any defects and/or deficiencies.</p> <p>If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 24.4.</p> <p>If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as at the date of the Contractor's repeated notice.</p> <p>If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.</p>
		24.6	If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.4 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 24.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.
		24.7	As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

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			In case the minor outstanding items / work (which do not materially affect the operations of the completed facilities) could not be completed even after six months of Completion of facilities of last unit due to reasons not attributable to Contractor, Contractor may request Employer for deletion of such outstanding items/work from Contractor's Scope with suitable rebate for facilitating early closure of the site establishment by the Contractor. Employer shall have absolute discretion to opt for such request of the Contractor. In case Employer opts for deletion, the rebate shall be mutually agreed between the Employer and Contractor. Further, such deletion of such minor outstanding items/work shall not dilute, relieve or absolve in any manner whatsoever the Contractor of any of its obligations including but not limited to Performance Guarantees and Warrantees under the contract unless otherwise expressly agreed.
		24.8	Upon Completion of Facilities , the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.
25.	Commissioning, Guarantee Tests and Operational Acceptance		
		25.1	<p>Commissioning</p> <p>25.1.1 Commissioning of the Facilities or any part thereof shall be completed by the Contractor as per procedures detailed in the Technical Specifications.</p> <p>The Employer shall, unless otherwise specified in Appendix 6 (Scope of Works and Supply by the Employer)/ Technical Specifications, supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning of the Facilities.</p>
		25.2	<p>Guarantee Test</p> <p>25.2.1 The Guarantee Test (and repeats thereof) shall be conducted by the Contractor as specified in the Technical Specifications or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Contract Documents. The Contractor's and Project Manager's advisory personnel shall attend the Guarantee Test. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to the conduct and results of the Guarantee Test (and any repeats thereof).</p> <p>25.2.2 If for reasons attributable to the Employer, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the timelines specified in the Technical Specifications, payment of Contractor shall be released as specified in Appendix-I (Payment terms).</p> <p>25.2.3 If for reasons attributable to the Employer, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period of twelve months from the timelines specified in the Technical Specifications, balance payment towards Guarantee Test, shall be released to the Contractor</p>

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		against Bank Guarantee as per Appendix-I (Payment terms). Such Bank Guarantee shall have initial validity of one (1) year. The Bank Guarantee shall be extended for any subsequent period, if required, such that the same remains valid till the Successful Completion of Guarantee Test.
	25.3	<p>Operational Acceptance</p> <p>25.3.1 Subject to GCC Sub-Clause 25.4 (Partial Acceptance) below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when any minor items mentioned in GCC Sub-Clause 24.7 hereof relevant to the Facilities or that part thereof have been completed and</p> <p>(a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or</p> <p>(b) the Contractor has paid the liquidated damages specified in GCC Sub-Clause 28.3 hereof; and</p> <p>25.3.2 At any time after any of the events set out in GCC Sub-Clause 25.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Bidding Documents or in another form acceptable to the Employer in respect of the Facilities or the part thereof specified in such notice as at the date of such notice.</p> <p>25.3.3 The Project Manager shall, after consultation with the Employer, and within forty five (45) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.</p> <p>25.3.4 If within forty five (45) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as at the date of the Contractor's said notice.</p>
	25.4	<p>Partial Acceptance</p> <p>25.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities.</p> <p>25.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate.</p>

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			F. Guarantees and Liabilities
26.	Completion Time Guarantee		
	26.1	The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified in the SCC) within the Time for Completion specified in the SCC pursuant to GCC Sub-Clause 8.2, or within such extended time to which the Contractor shall be entitled under GCC Clause 40 (Extension of Time for Completion) hereof.	
	26.2	<p>If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion), the Contractor shall pay to the Employer liquidated damages in the amount computed at the rates specified in the SCC. The aggregate amount of such liquidated damages shall in no event exceed the amount specified as "Maximum" in the SCC. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2.</p> <p>Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 40 (Extension of Time for Completion). The Contractor shall have no further liability whatsoever to the Employer in respect thereof.</p> <p>However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.</p> <p>Save for liquidated damages payable under this GCC Sub-Clause 26.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in Appendix 4 (Time Schedule) to the Contract Agreement and/or other program of work prepared pursuant to GCC Clause 18 (Program of Performance) shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.</p>	
	26.3	No bonus shall be given for earlier completion of the facilities or part thereof.	
27.	Defect Liability		
	27.1	The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed.	
	27.2	<p>The Defect Liability Period shall be eighteen (18) months from the date of Completion of the Facilities (or any part thereof) or twelve (12) months from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the SCC.</p> <p>If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Contractor shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible</p>	

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>for the repair, replacement or making good of any defect or of any damage to the Facilities arising out of or resulting from any of the following causes:</p> <p>(a) improper operation or maintenance of the Facilities by the Employer</p> <p>(b) operation of the Facilities outside specifications provided in the Contract</p> <p>(c) normal wear and tear.</p>
		27.3	<p>The Contractor's obligations under this GCC Clause 27 shall not apply to</p> <p>(a) any materials that are supplied by the Employer under GCC Sub-Clause 21.2 (Employer-Supplied Plant, Equipment and Materials), are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein</p> <p>(b) any designs, specifications or other data designed, supplied or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein</p> <p>(c) any other materials supplied or any other work executed by or on behalf of the Employer, except for the work executed by the Employer under GCC Sub-Clause 27.7.</p>
		27.4	<p>The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.</p>
		27.5	<p>The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 27.</p> <p>The Contractor may, with the consent of the Employer, remove from the Site any Plant and Equipment or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.</p>
		27.6	<p>If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.</p> <p>If such part fails the tests, the Contractor shall carry out further repair, replacement or making good (as the case may be) until that part of the Facilities passes such tests. The tests in character shall in any case be not less than what has already been agreed by the Employer and the Contractor for the original equipment/part of the Facilities.</p>
		27.7	<p>If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor,</p>

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		<p>proceed to do or get, such work done at the risk of the Contractor, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the Employer from any monies due to the Contractor or claimed under the Performance Security.</p> <p>If Employer gets such works done, the cost of getting such work done by the Employer shall be determined including Employer's pre-determined overhead (at the rate specified in SCC) on the value executed at the risk & cost of the contractor.</p>
	27.8	<p>If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons. Upon correction of the defects in the Facilities or any part thereof by repair/replacement, such repair/replacement shall have the Defect Liability Period extended by a period of twelve (12) month from the time such replacement/repair of the Facilities or any part thereof.</p> <p>However, Defect Liability Period for such repaired /replaced Facilities or any part thereof shall not be extended by more than a period of 36 months from Completion of Facilities and 30 months from Operational acceptance whichever is earlier excluding the period during which such facility could not be used due to the aforesaid defect.</p> <p>Further, in case of repeated defects (three or more times) observed for such repaired / replaced facility during the defect liability period including extended period, the Employer has right to recover the reasonable costs incurred by the Employer to make good of the said facility.</p> <p>If Employer gets such works done, the reasonable cost of getting such work done by the Employer shall be determined including Employer's predetermined overhead (at the rate specified in SCC) on the value executed.</p> <p>27.8.1 At the end of the Defect Liability Period, the contractor liability ceases except for latent defects. The contractor's liability for latent defects warranty shall be limited to a period of five (5) years from the end of Defect Liability Period. For the purpose of this clause, the latent defects shall be the defects inherently lying within the material or arising out of design deficiency which do not manifest themselves during the Defect Liability Period in this GCC clause 27, but later.</p> <p>In case, there is any dispute between Employer and Contractor regarding latent defects, a third party as mutually agreed upon by the Employer and the Contractor shall be engaged by the Employer for settling the dispute.</p> <p>The third party, so engaged by the Employer, shall be paid fee plus reasonable expenditures incurred in the execution of its duties as mentioned above. These costs shall be initially paid by the Employer. In case of latent defect being proved, such costs shall be recoverable from the Contractor and the Contractor shall bear and reimburse such costs to the Employer.</p>

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			If the dispute regarding latent defects cannot be settled as above, then the dispute shall be settled as per provision of GCC clause 6 (Settlement of Disputes).
		27.9	Except as provided in GCC Clauses 27 and 33 (Loss of or Damage to Property / Accident or Injury to Workers/Indemnification), the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant and Equipment, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, criminal or wilful action of the Contractor.
		27.10	In addition, the Contractor shall also provide an extended warranty for any such component of the Facilities and during the period of time as may be specified in the SCC. Such obligation shall be in addition to the defect liability specified under GCC Sub-Clause 27.2.
28.	Functional Guarantees		
		28.1	The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in Appendix 8 ("Functional Guarantees") to the Contract Agreement, subject to and upon the conditions therein specified.
		28.2	If, for reasons attributable to the Contractor, the guaranteed level of the Functional Guarantees specified in Appendix 8 (Functional Guarantees) to the Contract Agreement are not met either in whole or in part, the Contractor shall, within a mutually agreed time, at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall seek the Employer's consent to repeat the Guarantee Test. If the specified Functional Guarantees are not established even during the repeat of the Guarantee Test, the Employer may at its option, either <ul style="list-style-type: none"> (a) Reject the Equipment and recover the payments already made, or (b) Terminate the Contract pursuant to GCC Sub-Clause 42.2.2 and recover the payments already made, or (c) Accept the equipment after levy of liquidated damages in accordance with the provisions specified in Appendix-8(Functional Guarantees) to the Contract Agreement.
		28.3	In case the Employer exercises its option to accept the equipment after levy of liquidated damages, the payment of liquidated damages under GCC Sub-Clause 28.2, up to the limitation of liability specified in the Technical Specifications/Appendix-8 (Functional Guarantees) to the Contract Agreement, shall completely satisfy the Contractor's guarantees under GCC Sub-Clause 28.2, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.
29.	Patent Indemnity		

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
		29.1	<p>The Contractor shall, without prejudice to the Employer's compliance with GCC Sub-Clause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.</p> <p>Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement.</p>
		29.2	<p>If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Sub-Clause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.</p> <p>If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defence of any such proceedings or claim.</p> <p>The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.</p>
		29.3	<p>The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.</p>
30.	Limitation of Liability		
		30.1	<p>Except in cases of criminal negligence or willful misconduct,</p> <p>(a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which</p>

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			<p>may be suffered by the other Party in connection with the Contract, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer and</p> <p>(b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.</p> <p>(c) the aggregate liability of the Employer to the Contractor except for GCC sub-clause 29.3, whether under the Contract, in tort or otherwise, at any point of time during the execution/performance of the Contract, shall not exceed the 'total Contract Price less payments already released to the Contractor'.</p>
			G. Risk Distribution
31.	Transfer of Ownership		
		31.1	Ownership of the Plant and Equipment
			<p>Ownership of the Plant and Equipment (including spare parts) to be supplied from abroad and quoted in Schedule-1 shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant and Equipment (including spare parts) from the country of origin to that country where the site is located and upon endorsement of the dispatch documents in favour of the Employer.</p> <p>Ownership of the Plant and Equipment (including spare parts) quoted in Schedule-2 shall be transferred to the Employer when the Plant and Equipment are loaded on to the mode of transport to be used to convey the Plant and Equipment from the works to the site.</p>
		31.2	Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.
		31.3	Disposal of Surplus Material
			<p>"Ownership of any Plant and Equipment in excess of the requirements for the Facilities (i.e. surplus material) shall revert to the Contractor upon Completion of the Facilities and Guarantee Test or at such earlier time when the Employer and the Contractor agree that the Plant and Equipment in question are no longer required for the Facilities, provided quantity of any Plant and Equipment specifically stipulated in the Contract shall be the property of the Employer whether or not incorporated in the Facilities. The Contractor shall remove from the site such surplus material brought by him in pursuance of the Contract, subject to the Contractor producing the necessary clearance from the relevant authorities (Customs, GST etc.), if required by law, in respect of re-export or disposal of the surplus material locally. The liability for the payment of the applicable taxes/duties, if any, on the surplus material so re-exported and/or disposed locally shall be that of the Contractor.</p> <p>The Contractor shall also indemnify to keep the Employer harmless from any act of omission or negligence on the part of the Contractor in following</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			the statutory requirements with regard to removal/disposal of surplus material. The Indemnity-cum-Undertaking Agreement shall be furnished by contractor as per proforma enclosed in Section-VII (Part 3 of 3 - Forms and Procedures). Further, in case the laws require the Employer to take prior permission of the relevant Authorities before handing over the surplus material to the Contractor, the same shall be obtained by the Contractor on behalf of the Employer.
		31.4	Notwithstanding the transfer of ownership of the Plant and Equipment, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant and Equipment are incorporated.
		31.5	In case of two/three contracts entered into between the Employer and the Contractor as per GCC Sub-Clause 3.6 or where the Employer hands over his equipment to the Contractor for executing the Contract, then the Contractor shall at the time of taking delivery of the Equipment through Bill of Lading or other despatch documents furnish Trust Receipt for Plant, Equipment and Materials and also execute an Indemnity-cum-Undertaking Agreement in favour of the Employer in the form acceptable to Employer for keeping the equipment in safe custody and to utilise the same exclusively for the purpose of the said Contract. Proforma for the Trust Receipt and Indemnity-cum-Undertaking Agreement is enclosed under Section-VII (Forms and Procedures). The Employer shall also issue a separate Authorisation Letter to the Contractor to enable him to take physical delivery of plant, equipment and materials from the Employer as per proforma enclosed under Section-VII (Forms and Procedures).
32.	Care of Facilities		
		32.1	The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 24 (Completion of the Facilities) or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 27 (Defect Liability). Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 32.2 and 38.1.
		32.2	If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of (a) (insofar as they relate to the country where the Site is located) nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance,

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			<p>including War Risks and Political Risks, taken out under GCC Clause 34 (Insurance) hereof</p> <p>(b) any use or occupation by the Employer or any third party (other than a Subcontractor) authorized by the Employer of any part of the Facilities</p> <p>(c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed responsibility herein,</p> <p>the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 39 (Change in the Facilities). If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 39 (Change in the Facilities), excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub-Clause 42.1 (Termination for Employer's Convenience) hereof, except that the Contractor shall have no entitlement to profit under paragraph (e) of GCC Sub-Clause 42.1.3 in respect of any unexecuted Facilities as at the date of termination.</p>
		32.3	The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the Facilities, except (i) as mentioned in GCC Sub-Clause 32.2 (with respect to the Contractor's temporary facilities), and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Sub-Clauses 32.2(b) and (c) and 38.1.
		32.4	With respect to any loss or damage caused to the Facilities or any part thereof or to the Contractor's Equipment by reason of any of the matters specified in GCC Sub-Clause 38.1, the provisions of GCC Sub-Clause 38.3 shall apply.
33.	Loss of or Damage to Property; Accident or Injury to workers; Indemnification		
		33.1	Subject to GCC Sub-Clause 33.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property (other than the Facilities whether accepted or not), arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents.

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	33.2	<p>If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 33.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.</p> <p>If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defence of any such proceedings or claim.</p> <p>The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.</p>
	33.3	<p>The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 34 (Insurances), provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.</p>
	33.4	<p>The party entitled to the benefit of an indemnity under this GCC Clause 33 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the party fails to take such measures, the other party's liabilities shall be correspondingly reduced.</p>
34.	Insurance	
	34.1	<p>To the extent specified in Appendix 3 (Insurance Requirements) to the Contract Agreement, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.</p> <p>(a) Cargo Insurance During Transport</p> <p>Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant and Equipment (including spare parts therefor) and to the Contractor's Equipment.</p> <p>(b) Installation All Risks Insurance</p> <p>Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while</p>

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		<p>the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.</p> <p>(c) Third Party Liability Insurance</p> <p>Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property occurring in connection with the supply and installation of the Facilities.</p> <p>(d) Automobile Liability Insurance</p> <p>Covering use of all vehicles used by the Contractor or its Subcontractors (whether or not owned by them) in connection with the execution of the Contract.</p> <p>(e) Workers' Compensation</p> <p>In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.</p> <p>(f) Employer's Liability</p> <p>In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.</p> <p>(g) Other Insurances</p> <p>Such other insurances as may be specifically agreed upon by the parties hereto as listed in the said Appendix 3.</p>
	34.2	<p>The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1 except for the Cargo Insurance During Transport, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.</p>
	34.3	<p>The Contractor shall, in accordance with the provisions of Appendix 3 (Insurance Requirements) to the Contract Agreement, deliver to the Employer certificates of insurance (or copies of the insurance policies) as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.</p>
	34.4	<p>The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.</p>

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		34.5	The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in Appendix 3 (Insurance Requirements) to the Contract Agreement.
		34.6	If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 34.1, the Employer may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 34.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein.
		34.7	Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 34, and all monies payable by any insurers shall be paid to the Contractor as per the procedure outlined in GCC Sub-Clause 34.8 below. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.
		34.8	<p>(i) Wherever total damages/loss of equipment/material, would occur, the Contractor will be entitled to payment of all payments received from the underwriters except the following amounts:</p> <p>(a) The amount paid to the Contractor under the Contract in respect of equipment/material damaged/lost (excluding the pro-rata initial advance) but including the entire amount of escalation, if any, already paid to the Contractor.</p> <p>(b) Taxes and duties which have already been paid by the Employer.</p> <p>In the event the claim money settled, is less than the total of the amount in a & b above, then the entire claim money settled will be retained by the Employer and the Contractor will forthwith pay the Employer the short fall amount between the claim money and the total of amounts as per a & b mentioned above.</p> <p>Subsequent payments, if any, due under the Contract shall be regulated by the relevant terms of payment.</p> <p>(ii) In case of damage to any equipment/material during any stage, the Contractor upon rectification of the damaged equipment to the</p>

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			satisfaction of the Employer shall be paid to the extent of full claims settled by the underwriters.
35.	Unforeseen Conditions		
		35.1	<p>If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions (other than climatic conditions) or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities provided by the Employer, and on the basis of information that it could have obtained from a visual inspection of the Site (if access thereto was available) or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant and Equipment or Contractor's Equipment, notify the Project Manager in writing of</p> <p>(a) the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen</p> <p>(b) the additional work and/or Plant and Equipment and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions</p> <p>(c) the extent of the anticipated delay</p> <p>(d) the additional cost and expense that the Contractor is likely to incur.</p> <p>On receiving any notice from the Contractor under this GCC Sub-Clause 35.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken.</p>
		35.2	Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Sub-Clause 35.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price.
		35.3	If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Sub-Clause 35.1, the Time for Completion shall be extended in accordance with GCC Clause 40 (Extension of Time for Completion).
36.	Change in Laws and Regulations		
		36.1	If, after the date seven (7) days prior to the deadline set for Price Bid submission, in the country where the Site is located, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated or changed (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the costs and expenses of the Contractor and/or

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			the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. However, these adjustments shall not be applicable on procurement of raw materials, intermediary components, and intermediary services etc. by the Contractor. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with the Appendix 2 to the Contract Agreement.
37.	Force Majeure		
		37.1	“Force Majeure” shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected.
		37.2	If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within fourteen (14) days after the occurrence of such event.
		37.3	The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party’s performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40 (Extension of Time for Completion).
		37.4	The party or parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfil its or their obligations under the Contract, but without prejudice to either party’s right to terminate the Contract under GCC Sub-Clauses 37.6 and 38.5.
		37.5	No delay or non-performance by either party hereto caused by the occurrence of any event of Force Majeure shall (a) constitute a default or breach of the Contract (b) (subject to GCC Sub-Clauses 32.2, 38.3 and 38.4) give rise to any claim for damages or additional cost or expense occasioned thereby if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure.
		37.6	If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the currency of the Contract, the parties will attempt to develop a mutually satisfactory solution, failing which the dispute shall be resolved in accordance with GCC Clause 6.
		37.7	Notwithstanding GCC Sub-Clause 37.5, Force Majeure shall not apply to any obligation of the Employer to make payments to the Contractor herein.

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38.	War Risks		
		38.1	<p>“War Risks” shall mean any of the following events occurring or existing in or near the country (or countries) where the Site is located:</p> <ul style="list-style-type: none"> (a) war, hostilities or warlike operations (whether a state of war is declared or not), invasion, act of foreign enemy and civil war (b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts, and (c) any explosion or impact of any mine, bomb, shell, grenade or other projectile, missile, munitions or explosive of war.
		38.2	<p>Notwithstanding anything contained in the Contract, the Contractor shall have no liability whatsoever for or with respect to</p> <ul style="list-style-type: none"> (a) destruction of or damage to Facilities, Plant & Equipment, or any part thereof (b) destruction of or damage to property of the Employer or any third party (c) injury or loss of life <p>if such destruction, damage, injury or loss of life is caused by any War Risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges or expenses arising in consequence of or in connection with the same.</p>
		38.3	<p>If the Facilities or any Plant and Equipment or Contractor’s Equipment or any other property of the Contractor used or intended to be used for the purposes of the Facilities shall sustain destruction or damage by reason of any War Risks, the Employer shall pay the Contractor for</p> <ul style="list-style-type: none"> (a) any part of the Facilities or the Plant and Equipment so destroyed or damaged (to the extent not already paid for by the Employer) (b) replacing or making good any Contractor’s Equipment or other property of the Contractor so destroyed or damaged so far as may be required by the Employer, and as may be necessary for completion of the Facilities, (c) replacing or making good any such destruction or damage to the Facilities or the Plant and Equipment or any part thereof. <p>If the Employer does not require the Contractor to replace or make good any such destruction or damage to the Facilities, the Employer shall either request a change in accordance with GCC Clause 39 (Change in the Facilities), excluding the performance of that part of the Facilities thereby destroyed or damaged or, where the loss, destruction or damage affects a substantial part of the Facilities, shall terminate the Contract, pursuant to GCC Sub-Clause 42.1 (Termination for Employer’s Convenience).</p>
		38.4	<p>Notwithstanding anything contained in the Contract, the Employer shall pay the Contractor for any increased costs or incidentals to the execution</p>

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			of the Contract that are in any way attributable to, consequent on, resulting from, or in any way connected with any War Risks, provided that the Contractor shall as soon as practicable notify the Employer in writing of any such increased cost.
		38.5	If during the performance of the Contract any War Risks shall occur that financially or otherwise materially affect the execution of the Contract by the Contractor, the Contractor shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its and its Subcontractors' personnel engaged in the work on the Facilities, provided, however, that if the execution of the work on the Facilities becomes impossible or is substantially prevented for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of any War Risks, the parties will attempt to develop a mutually satisfactory solution, failing which the dispute will be resolved in accordance with GCC Clause 6.
		38.6	In the event of termination pursuant to GCC Sub-Clauses 38.3, the rights and obligations of the Employer and the Contractor shall be specified in GCC Sub-Clauses 42.1.2 and 42.1.3, except that the Contractor shall have no entitlement to profit under paragraph (e) of GCC Sub-Clause 42.1.3 in respect of any unexecuted Facilities as of the date of termination.
H. Change in Contract Elements			
39.	Change In The Facilities		
		39.1	<p>Introducing a Change</p> <p>39.1.1 The Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Facilities (hereinafter called "Change"), provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract .</p> <p>39.1.2 The Contractor may from time to time during its performance of the Contract propose to the Employer (with a copy to the Project Manager) any Change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the Facilities. The Employer may at its discretion approve or reject any Change proposed by the Contractor.</p> <p>39.1.3 Notwithstanding GCC Sub-Clauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.</p> <p>39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 39.2 and 39.3.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
	39.2	<p>Changes Originating from Employer</p> <p>39.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 39.1.1, it shall send to the Contractor a “Request for Change Proposal,” requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a “Change Proposal,” which shall include the following:</p> <ul style="list-style-type: none"> (a) brief description of the Change (b) effect on the Time for Completion (c) estimated cost of the Change (d) effect on Functional Guarantees (if any) (e) effect on any other provisions of the Contract. <p>39.2.2 The pricing of any change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If the rates and prices of any change are not available in the Contract, the parties thereto shall agree on specific rates for the variation of the change.</p> <p>39.2.3 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen (15) percent, the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor’s objection, the Employer and the Contractor shall agree on specific rates for valuation of the change.</p> <p>39.2.4 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained including agreement on rates if such rates are not available in the Contract or if the limit of 15% set forth in Clause 39.2.3 has been exceeded. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.</p> <p>If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision.</p> <p>If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly.</p> <p>39.2.5 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a “Pending Agreement Change Order.”</p> <p>Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The parties shall thereafter attempt to</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>reach agreement on the outstanding issues under the Change Proposal.</p> <p>If the parties cannot reach agreement within sixty (60) days from the date of issue of the Pending Agreement Change Order, then the matter may be referred to the Expert Settlement Council (ESC) in accordance with the provisions of GCC Sub-Clause 6.4.1.</p>
		39.3	<p>Changes Originating from Contractor</p> <p>39.3.1 If the Contractor proposes a Change pursuant to GCC Sub-Clause 39.1.2, the Contractor shall submit to the Project Manager a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Sub-Clause 39.2.1.</p> <p>Upon receipt of the Application for Change Proposal, the parties shall follow the procedures outlined in GCC Sub-Clauses 39.2.4 and 39.2.5.</p>
40.	Extension of Time for Completion		
		40.1	<p>The Time(s) for Completion specified in the SCC shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:</p> <ul style="list-style-type: none"> (a) any Change in the Facilities as provided in GCC Clause 39 (Change in the Facilities); (b) any occurrence of Force Majeure as provided in GCC Clause 37 (Force Majeure), unforeseen conditions as provided in GCC Clause 35 (Unforeseen Conditions), or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clause 32.2; (c) any suspension order given by the Employer under GCC Clause 41 (Suspension) hereof or reduction in the rate of progress pursuant to GCC Sub-Clause 41.2; (d) any changes in laws and regulations as provided in GCC Clause 36 (Change in Laws and Regulations); (e) any default or breach of the Contract by the Employer, specifically including failure to supply the items listed in Appendix 6 (Scope of Works and Supply by the Employer) to the Contract Agreement, or any activity, act or omission of any other contractors employed by the Employer or failure to give possession of site under GCC Clause 10.2; (f) any other matter specifically mentioned in the Contract; <p>by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.</p>
		40.2	<p>Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Employer's estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter to the Expert Settlement Council (ESC), pursuant to GCC Sub-Clause 6.4.1.
		40.3	The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.
		40.4	<p>Documents for Consideration of Time Extension</p> <p>The following documents shall form the principal basis for consideration of Time Extension pursuant to GCC clause 40 with or without LD, levy of liquidated damages pursuant to GCC clause 26 and settlement of extra claims during the execution of contract:</p> <ol style="list-style-type: none"> 1. The joint recordings in "Hindrance Register" and "Weekly Review Register". 2. Records of Technical Coordination Meetings. 3. Records of Contract Review meetings. 4. Written notices issued by the "Project Manager" or his authorized representative to Contractor in the relevant period.
41.	Suspension		
		41.1	<p>The Employer/ Project Manager may, by notice to the Contractor, order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons therefor. The Contractor shall thereupon suspend performance of such obligation (except those obligations necessary for the care or preservation of the Facilities) until ordered in writing to resume such performance by the Project Manager/ Employer.</p> <p>If, by virtue of a suspension order given by the Project Manager/Employer, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than ninety (90) days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within twenty-eight (28) days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 39 (Change in the Facilities), excluding the performance of the suspended obligations from the Contract.</p> <p>If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 39 (Change in the Facilities) or, where it</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			affects the whole of the Facilities, as termination of the Contract under GCC Sub-Clause 42.1 (Termination for Employer's Convenience).
		41.2	<p>If</p> <p>(a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice or</p> <p>(b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Sub-Clause 10.2, or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities;</p> <p>then the Contractor may by fourteen (14) days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.</p>
		41.3	<p>If the Contractor's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GCC Clause 41, then the Time for Completion shall be extended in accordance with GCC Sub-Clause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.</p> <p>The Bank Guarantee Charges and Insurance Charges for the extended period shall be reimbursed at actuals based on the written request of Contractor.</p> <p>The reimbursement of BG charges shall be made on the basis of documentary evidence submitted by the Contractor (such as debit advice of Bank) along with a Certificate from the issuing Bank, as per the format enclosed in Section-VII (Forms & Procedures).</p> <p>Further, the reimbursement of Insurance charges shall also be made on the basis of documentary evidence submitted by the Contractor. In addition, the Contractor should obtain Insurance Policy directly from the Insurance Company and not through Brokers.</p> <p>The aforesaid reimbursement of Bank Guarantee Charges and Insurance Charges shall be inclusive of GST.</p>
		41.4	During the period of suspension, the Contractor shall not remove from the Site any Plant and Equipment, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
42.	Termination		
	42.1	<p>Termination for Employer's Convenience</p> <p>42.1.1 The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Sub-Clause 42.1.</p> <p>42.1.2 Upon receipt of the notice of termination under GCC Sub-Clause 42.1.1, the Contractor shall either immediately or upon the date specified in the notice of termination</p> <ul style="list-style-type: none"> (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii) below (c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition. The Contractor shall vacate the Site within thirty (30) days from the date of termination or such period as advised by the Employer. <p>In case, the Contractor does not vacate the site within thirty (30) days from the date of termination or such period as communicated by the Employer, the Employer may take appropriate measures for such vacation of the Site and the expenses, if any, incurred in this regard shall be recovered from the Contractor.</p> <ul style="list-style-type: none"> (d) In addition, the Contractor, subject to the payment specified in GCC Sub-Clause 42.1.3, shall <ul style="list-style-type: none"> (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant and Equipment as at the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors (iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities. 	

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>42.1.3 In the event of termination of the Contract under GCC Sub-Clause 42.1.1, the Employer shall pay to the Contractor the following amounts:</p> <ul style="list-style-type: none"> (a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination (b) the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel (c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges (d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.1.2 (e) the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above. <p>42.1.4 For the work done by the Contractor till the date of termination of the contract pursuant to GCC Sub-clause 42.1.1 joint measurement of the work shall be undertaken for which the Contractor shall be present at the site on the date specified by the Employer, which shall be no later than 15 days from the date of notice of termination. Joint measurement of all works shall be completed within 30 days from the date of termination. In case, the Contractor does not turn up or does not depute his authorized representative within 15 days from the date of notice of termination for joint measurement, the Employer shall carry out the measurement through independent third party and such measurements shall, notwithstanding such absence of Contractor or his authorised representative, be deemed to be joint measurement pursuant to this clause 42.1.4 and shall be binding upon the Contractor whether or not he shall have signed the measurement books etc. and no claim whatsoever shall thereafter be entertained regarding the accuracy or otherwise of measurement/ any other issues related there to.</p>
	42.2	<p>Termination for Contractor's Default</p> <p>42.2.1 The Employer, without prejudice to any of its other rights or remedies under the Contract or in law or otherwise it may possess, may terminate the Contract forthwith in any of the following circumstances by giving a notice of termination and its reasons therefor to the Contractor, referring to this GCC Sub-Clause 42.2:</p> <ul style="list-style-type: none"> (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt</p> <p>(b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43 (Assignment).</p> <p>(c) if the Contractor, in the opinion of the Employer has engaged in corrupt or fraudulent or anti-competitive or coercive or obstructive practices in bidding for or in executing the Contract.</p> <p>For the purpose of this Sub Clause:</p> <p>i) "Corrupt practice" means the offering, giving, receiving or soliciting money or of anything of value to influence the action of a public official in the procurement process or in contract execution or outcome of the bidding process;</p> <p>ii) "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition;</p> <p>iii) "Anti-competitive practice": any collusion, bid rigging or anti-competitive arrangement, or any other practice coming under the purview of The Competition Act, 2002, between two or more bidders, with or without the knowledge of the Employer, that may impair the transparency, fairness and the progress of the procurement process or to establish bid prices at artificial, non-competitive levels;</p> <p>iv) "Coercive practice": harming or threatening to harm, persons or their property to influence their participation in the procurement process or affect the award or execution of a contract;</p> <p>v) "Obstructive practice": materially impede the Employer's investigation into allegations of one or more of the above mentioned prohibited practices either by deliberately destroying, falsifying, altering; or by concealing of evidence material to the investigation; or by making false statements to investigators and/ or by threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or by impeding the Employer's rights of audit or access to information.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>(d) If the Contractor, sub-contracts any part of the works in violation of the provision of GCC Clause 19.4.</p> <p>42.2.2 (i) If the Contractor</p> <ul style="list-style-type: none"> (a) has abandoned or repudiated the Contract (b) has without valid reason failed to commence work on the Facilities promptly or has suspended (other than pursuant to GCC Sub-Clause 41.2) the progress of Contract performance for more than twenty-eight (28) days after receiving a written instruction from the Employer to proceed (c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause (d) refuses or is unable to provide sufficient materials, services or labour to execute and complete the Facilities in the manner specified in the program furnished under GCC Clause 18 (Program of Performance) at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended <p>(ii) If the Executant(s) of DJU(s) / Letter(s) of Undertaking (other than contractor) / Collaborator(s) / Associate(s) /Licensor(s) /Technology Provider(s) fails to carry out its obligations, in connection with the contract</p> <p>then the Employer may, without prejudice to any of its other rights and remedies it may possess under the Contract or in law or otherwise, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within fourteen (14) days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Sub-Clause 42.2.</p> <p>42.2.3 Upon receipt of the notice of termination under GCC Sub-Clauses 42.2.1 or 42.2.2, the Contractor shall, either immediately or upon such date as is specified in the notice of termination,</p> <ul style="list-style-type: none"> (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) below (c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>(d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Works and to the Plant and Equipment as at the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors</p> <p>(e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities.</p> <p>(f) Contractor shall vacate (except the Contractor's Equipment as provided in GCC Clause 42.2.4) the Site within thirty (30) days from the date of termination or such period as advised by the Employer.</p> <p>In case, the Contractor does not vacate the site within thirty (30) days from the date of termination or such period as communicated by the Employer, the Employer may take appropriate measures for such vacation of the Site and the expenses, if any, incurred in this regard shall be recovered from the Contractor.</p> <p>42.2.4 The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third party at the risk and cost of the Contractor. The Employer may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Employer and with an indemnification by the Employer for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities.</p> <p>Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.</p> <p>If Employer gets such works done, the cost of getting such work done by the Employer shall be determined including Employer's pre-determined overhead (at the rate specified in SCC) on the value executed at the risk & cost of the contractor.</p> <p>42.2.5 Subject to GCC Sub-Clause 42.2.6, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as at the date of termination, the value of any unused or partially used Plant and Equipment on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.2.3. Any sums due to the Employer from the Contractor</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract.</p> <p>42.2.6 For work done till the date of termination of the Contract pursuant to GCC Sub-clauses 42.2.1 and/or 42.2.2 Joint measurement of the work shall be undertaken for which, the Contractor shall be present at the site on the date specified by the Employer, which shall be no later than 15 days from the date of notice of termination. Joint measurement of all works shall be completed within 30 days from the date of termination. In case, the Contractor does not turn up or does not depute his authorized representative within 15 days from the date of notice of termination for joint measurement, the Employer shall carry out the measurement through independent third party and such measurements shall, notwithstanding such absence of Contractor or his authorised representative, be deemed to be joint measurement pursuant to this GCC Sub-clause 42.2.6 and shall be binding up-on the Contractor whether or not he shall have signed the measurement books etc. and no claim whatsoever shall thereafter be entertained regarding the accuracy of measurement/ any other issues related there to.</p> <p>42.2.7 If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined including Employer's pre-determined overhead (at the rate specified in SCC) on the value executed at the risk & cost of the contractor.</p> <p>If the sum that the Contractor is entitled to be paid, pursuant to GCC Sub-Clause 42.2.5, plus the reasonable costs inclusive of Employer's pre-determined overheads (at the rate specified in SCC) on the costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the Contractor shall be liable for such excess.</p> <p>If such excess is greater than the sums due to the Contractor under GCC Sub-Clause 42.2.5, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due to the Contractor under GCC Sub-Clause 42.2.5, the Employer shall pay the balance to the Contractor.</p> <p>The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.</p>
	42.3	Termination by Contractor
		<p>42.3.1 If</p> <p>(a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to Appendix 1 (Terms and Procedures of Payment) of the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay</p>

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		<p>such sum, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice, or</p> <p>(b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities which the Employer is required to obtain as per provision of the Contract or as per relevant applicable laws of the country,</p> <p>then the Contractor may give a notice to the Employer thereof, and if the Employer has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within twenty-eight (28) days of such notice, or if the Contractor is still unable to carry out any of its obligations under the Contract for any reason attributable to the Employer within twenty-eight (28) days of the said notice, the Contractor may by a further notice to the Employer referring to this GCC Sub-Clause 42.3.1, forthwith terminate the Contract.</p> <p>42.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Employer to that effect, referring to this GCC Sub-Clause 42.3.2, if the Employer becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Employer takes or suffers any other analogous action in consequence of debt.</p> <p>42.3.3 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, then the Contractor shall immediately</p> <p>(a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition</p> <p>(b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d)(ii)</p> <p>(c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractor's personnel from the Site</p> <p>(d) In addition, the Contractor, subject to the payment specified in GCC Sub-Clause 42.3.4, shall</p> <p>(i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
			<p>(ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant and Equipment as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors</p> <p>(iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.</p> <p>42.3.4 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, the Employer shall pay to the Contractor all payments specified in GCC Sub-Clause 42.1.3 and reasonable compensation for all loss or damage sustained by the Contractor arising out of, in connection with or in consequence of such termination.</p> <p>42.3.5 Termination by the Contractor pursuant to this GCC Sub-Clause 42.3 is without prejudice to any other rights or remedies of the Contractor that may be exercised in lieu of or in addition to rights conferred by GCC Sub-Clause 42.3.</p>
		42.4	In this GCC Clause 42, the expression “Facilities executed” shall include all work executed, Installation Services provided, any or all Plant and Equipment acquired (or subject to a legally binding obligation to purchase) by the Contractor and used or intended to be used for the purpose of the Facilities, up to and including the date of termination.
		42.5	In this GCC Clause 42, in calculating any monies due from the Employer to the Contractor, account shall be taken of any sum previously paid by the Employer to the Contractor under the Contract, including any advance payment paid pursuant to Appendix 1 (Terms and Procedures of Payment) to the Contract Agreement.
43.	Assignment		
		43.1	The Contractor shall not, without the express prior written consent of the Employer, assign to any third party the Contract or any part thereof, or any right, benefit, obligation or interest therein or thereunder, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract, barring Contractor’s obligations with respect to the Escrow for provision under GCC clause 12.4, which cannot be assigned.
			I. Other Conditions
44.	Contractor Performance Feedback and Evaluation System		
			<p>The Employer has in place an established ‘Contractor Performance and Feedback System’ against which the Contractor’s performance during the execution of Contract shall be evaluated on a continuous basis at regular intervals on the following seven parameters:</p> <ul style="list-style-type: none"> • Engineering & Quality Assurance Capability • Finance

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<ul style="list-style-type: none"> • Supply • Construction/ Installation • Field Quality • Safety • Claims & Disputes <p>The score-based feedback formats based on which Contractor's performance shall be evaluated is enclosed at Annexure-A.</p> <p>In case the performance of the Contractor is found unsatisfactory, the Contractor shall be considered ineligible for participating in future tenders for two years.</p> <p>On completion of the above ineligibility period, the Contractor would be required to submit a request to Employer/NVVN for participating in future tenders specifying the measures taken to improve their performance. The Contractor may also request for early revocation of suspension after completion of at least one (1) year of the suspension period. On receipt of such request, the performance of the Contractor shall be assessed/evaluated by Employer/NTPC and if the performance is found to be satisfactory, the Contractor shall be considered eligible for participation in future tenders.</p>
45.	Fraud Prevention Policy	
		<p>The contractor along with their associate / collaborator / subcontractors / sub-vendors / consultants / service providers shall strictly adhere to the Fraud Prevention policy of the Employer displayed on its tender website http://www.ntpctender.ntpc.co.in. The Contractor along with their associate / collaborator / subcontractors / sub-vendors / consultants / service providers shall observe the highest standard of ethics and shall not indulge or allow anybody else working in their organization to indulge in fraudulent activities during execution of the contract. The contractor shall immediately apprise the Employer about any fraud or suspected fraud as soon as it comes to their notice.</p>
46.	Debarment	
		<p>The Contractor acknowledges and agrees to the Employer's Policy for Debarment from Business Dealings ("Debarment Policy") displayed on the website www.ntpctender.ntpc.co.in and agrees and undertakes not to do any act, deed or thing which is contrary to or in breach.</p> <p>The version of Debarment Policy presently followed by NVVN is Rev. 04. The Contractor may be debarred from Business dealings on account of any Default by the Contractor under GCC Clause 42.2.1 & 42.2.2 or any of the grounds as detailed in the said Debarment Policy.</p> <p><i>(Presently Rev.04 version of Policy is in use. However, Package Coordinator to check and specify the version available at website www.ntpctender.ntpc.co.in).</i></p>
47	Integrity Pact	
		<p>If the Employer has terminated the Contract pursuant to Section-3 of the Integrity Pact (IP), the Employer shall encash the Contract Performance Bank Guarantee, in accordance with Section-4 of the Integrity Pact.</p>

Clause No.	GENERAL CONDITIONS OF CONTRACT (GCC)		
48	Independent External monitors		
			<p>Independent External Monitors</p> <p>The Nodal Officer for necessary coordination with Independent External Monitors shall be as under:</p> <ul style="list-style-type: none"> (i) Concerned Group Head in CC&M: if the issue pertains to awarding of Contract by CC&M (ii) Concerned Group Head of C&M under respective CPG of USSC : if the issue pertains to awarding of Contract by USSC (iii) Concerned Head of Department: if the issue pertains to other departments (iv) Head of Project/ Station : if the issue pertains to post-award execution or award of Contract by Project/ Station
49	Contractor's Labour Information Management System (CLIMS)		
		49.1	<ul style="list-style-type: none"> (a) The Contractor has to necessarily get itself registered in the Contractor's Labour Information Management System (CLIMS), which will be installed by the Employer. (b) The entry and exit of all contract labour to the plant premises will be through Gate Access Control System of above 'Contractor's Labour Information Management System'. (c) It will be responsibility of the Contractor to ensure timely exit of all labours from the plant premises after completion of job of that day. (d) The Contractor has to abide with all the statutory compliance applicable to its workers and employees and update the details of the same in the above system.
50	No Claim for interest or damage		
		50.1	<p>Interest on money due to the contractor:</p> <p>Contractor shall not be entitled to any interest or damage in case of any delay on the part of the Employer to pay the amount due upon measurement or as per Contract or otherwise. Contractor shall also not be entitled to interest upon any guarantee/ security/ retention money or payments in arrears or upon any balance which may on the final settlement of his account be due to him.</p>
		50.2	<p>No claim for interest or damage:</p> <p>No claim for interest or damage will be entertained or be payable by the Employer in respect of any amount or balance which may be lying with the Employer or may become due upon settlement/adjudication of any dispute, difference or misunderstanding between the parties by way of arbitration or court proceedings or otherwise or in respect of any delay or omission on the part of the Employer in making intermediate or final payment or in respect of any amount/damage which may be claimed through arbitration or court proceedings or in any other respect whatsoever.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
51	Human Resources	51.1	The Contractor for the purpose of the Contract shall engage / employ adequate number of key personnel in all areas such as design, engineering, construction, installation, planning, scheduling and carrying out of all maintenance of his plant and equipment, safety and competent and skilled work force as directed by the Project Manager. The Project Manager will approve any proposed replacement of such key personnel including work force only if their qualifications, experience, competence and capabilities are substantially equal to or better than those personnel originally identified and approved by the Project Manager.
		51.2	The Project Manager may require the Contractor to remove from Site of Works or from any other area of Work related to the Contract, any member of the Contractor personnel or work force who <ul style="list-style-type: none"> (i) Persists in any misconduct or lack of care (ii) Performs his duties incompetently or negligently or otherwise carelessly (iii) Fails to conform with any provisions of the Contract or (iv) Persists in any conduct which is prejudicial to the safety, health or protection of the Work and environment.
		51.3	If appropriate, the Contractor shall appoint a suitable replacement within fourteen (14) days or within such period as may be agreed between the Project Manager and Contractor. The Contractor shall unless otherwise provided in the Contract, make his own arrangement for engagement of all staff and labor, local or otherwise and for their payment, housing, transport, lodging and welfare as may be required by law and or by industry practice. The Contractor shall provide the Project Manager a return in detail in such form and at such intervals as he may reasonably prescribe showing the staff and number of the several classes of labour and other staff from time to time employed by the Contractor at Site or in connection with the Work along with such information as the Project Manager may reasonably require.
		51.4	Labor laws and Regulations and compliance thereof 51.4.1 During the entire period of Contract, the Contractor and his Sub-Contractors shall, at all times abide by all existing labor enactments, rules made therein, regulations, notifications and bye-laws by the appropriate government, local authority or any other labor laws or notification that may be issued under any labor law prevailing as on the date seven (7) days prior to the date set for opening of the Techno-Commercial Bids, published by the State or Central Government or Local Authorities. An illustrative list of applicable acts, notifications, rules etc. in connection with the labor as applicable as mentioned subsequently at para 51.4.8 in GCC. This list is not in any way exhaustive and shall not absolve the Contractor from any of his liabilities or responsibilities in compliance with any other laws, regulations, notifications that may be in force during the tenure of Contract.

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>51.4.2 The Contractor and his Sub-Contractors shall indemnify the Employer, from any action taken against the Employer by any competent authority in connection with the enforcement of the applicable laws, regulations, notifications, on account of contravention of any of the provisions therein, including amendments thereto. If the Employer is caused to pay or otherwise made liable, such amounts as may be necessary for non-observance of the provisions stipulated in the laws, rules, notifications including amendments, if any on the part of the Contractor and/or his Sub-Contractors, the Project Manager / Employer shall have the right to deduct any such money from any amount due to the Contractor including his performance security, under the Contract. The Employer shall also have the right to recover from the Contractor any sum required or estimated as required for making good any loss or damage suffered / likely to be suffered by the Employer, on this account.</p>
		<p>51.4.3 If due to an enactment of any new Act or Statute and rules made thereunder or any modification to the Acts/ Statute or rules made thereunder, all after seven (7) days prior to the date set for opening of the Techno-Commercial Bids and as a consequence thereof, the Contractor has to incur additional cost or expenditure, the same will be reimbursed by the Employer to the Contractor, excepting those due to reasons attributable to the Contractor and those being already compensated by other provisions of the Contract, like Price Adjustment, Taxes and Duties etc.</p>
		<p>51.4.4 It is specifically agreed that the Contractor and his Sub-Contractors shall obtain all the necessary registration, licenses, permits, authorizations etc. required under various enactments/ Regulations enforced from time to time, specifically registration as employer under Provident Fund Act and Contract Labor Regulation & Abolition Act, and the Employer shall not be liable for any violation by the Contractor in this regard.</p>
		<p>51.4.5 The employees of the Contractor or his Sub-Contractor(s) shall in no case be treated as the employees of the Employer at any point of time.</p>
		<p>51.4.6 The Contractor and his Sub-Contractors shall be liable to make all due payments to all their employees and ensure compliance with labor laws. If the Employer, is held liable as 'PRINCIPAL EMPLOYER' or otherwise to incur any expenditure or to make any contributions under any legislation of the Government or Court decision, in respect of the employees of the Contractor or his Sub-Contractors, then the Contractor would reimburse the amounts of such expenditure/contribution so made by the Employer.</p>
		<p>51.4.7 In case the ESI act is not applicable to the area where the Work is executed, as evidenced by the Certificate/Letter submitted to this effect from the local authorities, the Contractor shall be liable to arrange and pay for the expenses towards the medical treatment in respect of all labor employed by him for the execution of the Contract.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		<p>51.4.8 The number and other relevant details of key personnel required to be engaged/ employed by the Contractor in all areas shall be finalized with the successful bidder during post bid discussions (if required).</p> <p>During the entire period of Contract, the Contractor and his Sub-Contractors shall, at all times abide by the following Acts/ Statutes related to Human Resources:</p> <ol style="list-style-type: none"> 1. Factories Act, 1948; Contract Labor (Regulation & Abolition) Act, 1970; 2. EPF & MP Act, 1952; 3. Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996; 4. ESI Act, 1948; 5. Minimum Wages Act, 1948; 6. Payment of Wages Act, 1936; 7. Payment of Bonus Act, 1965; 8. Payment of Gratuity Act, 1972; 9. Workmen's Compensation Act, 1923; 10. ID Act, 1947; 11. Maternity Benefit Act, 1961; 12. Inter-State Migrant Workmen (Regulation of Employment & Conditions of Service) Act, 1979; 13. Fatal Accidents Act, 1855 14. Model Welfare Code <p>The above will deem to include all relevant/applicable rules made thereunder, regulations, notifications and bye laws of the State or Central Govt. or the local authority and any other labor law (including rules) regulations, bye laws as well as those that may be passed or notification that may be issued under any labor law present and in future either by State or Central Govt. or by local authority.</p>
52	Materials obtained from Excavation	Materials of any kind obtained from excavation on the Site shall remain the property of the Employer and shall be disposed of as the Project Manager may direct.
53	Treasure, Trove, Fossils, etc	All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall be the absolute property of the Employer and the Contractor shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing, shall immediately upon discovery thereof and before removal acquaint the Project Manager with such discovery and carry out the Project Manager's directions as to the disposition of the same, at the cost of the Employer.
54	Protection of Trees	Trees shall be protected from damage during the course of the Works and earth level within at least one (1) meter of each such tree shall not be disturbed. Where necessary, such trees shall be protected by providing temporary fencing at the cost of the Employer.

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
55	Security Watch and Lighting		The Contractor shall provide and maintain at his own expense all lights, guards, fencing and watching when and where necessary or required by the Project Manager for the protection of the Works or for the safety and convenience of those employed on the Works or the public.
56	Prevention of Pollution		The Contractor shall make necessary arrangement to prevent pollution of the water in any adjacent water bodies including stream, springs, nallah, river and lakes etc. The Contractor shall be solely responsible and liable for all damage caused by any pollution that may take place during the execution of the Work.
57	Explosives		Permission for the use of explosives shall be obtained from the Project Manager or from any appropriate authority as directed by the Project Manager and all explosive materials shall be used only under close supervision. It shall be the responsibility of the Contractor to seek and obtain any necessary permits, and to ensure that the requirements of the authorities are complied with, in all respects. Failure to do so may result in the Project Manager withdrawing permission to use explosives. The indemnification provided for, under the General Condition of Contract shall include indemnification against all claims in respect of any incident arising from the use of explosives.
58	Royalty	58.1	If the Contractor intends to engage itself in quarrying or mining of soil/earth, sand, stone/aggregates, metals, minerals or minor minerals required for the Civil works, as the case may be, it shall obtain necessary permits under the applicable law for such mining or quarrying from the State/Central Government authorities and pay the fee or charges applicable thereto. The Civil works component of the Contract Price shall be inclusive of any Royalties and/or Seigniorage Fee and/or Cess and /or other charges payable on the quarried and /or mined metal, minerals, and/ or minor minerals, as the case may be, at the rate(s) prevailing as on seven (7) days prior to the deadline set for Price Bid submission.
		58.2	<p>58.2.1 It shall be the responsibility of the Contractor to ensure that the Royalties and /or Seigniorage Fee and/or Cess and /or other charges on the quarried and /or mined metal, minerals and /or minor minerals are paid to the statutory authorities.</p> <p>58.2.2 The component of Royalties and/or Seigniorage Fee and/or Cess and /or other charges, if applicable in a running account bill, shall only be released by the Employer to the Contractor on submission of the following documents in original:</p> <p>A) In case the Contractor is the primary license holder of the quarry / mines:</p> <p>i) Vehicle wise challan / transit permit and proof of payment of royalty, and</p> <p>ii) Any other document required as per the relevant Acts/Rules of the concerned state.</p> <p>B) In case the Contractor is the purchaser of soil/earth, sand, stone/aggregates, metals, minerals or minor minerals:</p> <p>i) Purchase voucher and vehicle wise challan / transit permit and proof of payment of royalty, and</p> <p>ii) Any other document required as per the relevant Acts/Rules of the concerned state.</p>

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)	
		58.2.3	In case the Contractor fails to provide the required proof of royalty payment with the RA bill then an amount based on the prevailing rates of the royalty shall be retained from the respective RA bill, as security against royalty, which shall be refunded to the Contractor on submission of proof of royalty payment.
		58.2.4	The Contractor shall pay and indemnify the Employer against any default in payment of Royalties and /or Seigniorage Fee and/or Cess and/or other charges by the Contractor or the agency from which the Contractor purchases soil/earth, sand, stone/aggregates, metals, minerals and/or minor minerals.
		58.2.5	In the event of there being a statutory increase in the rates of royalty charges and/or Seigniorage Fees and/or Cess and/or other charges /fresh levy of royalty and/or Seigniorage Fees and/or Cess and/or other charges on materials, the same shall be reimbursed to the Contractor upon submission of original challan by him of having made the payments at revised rates. In the event of there being a decrease in such rates, the same shall be recovered from the Contractor. The base date for calculating the increase or decrease shall be the rate as on seven (7) days prior to the deadline set for Price Bid submission. The total reimbursement (positive or negative) as specified above, to be paid or recovered, shall however be calculated on the quantity of materials actually considered while making the royalties and /or Seigniorage Fee and/or Cess and/or other charges payments to the concerned authorities, or the theoretical consumption of these materials (calculated on the basis of the volume of concrete or fill accepted for payment), whichever is less, and on the basis of documentary evidence of Govt. Notification. However, the Contractor will settle claims, if any, on account of over charge by the State Authorities.
59	Procedure for Contract Closing	59.1	The closing of the contract shall be effected after the warranty period/Defect Liability Period is successfully completed and the CPG of the Contractor is returned/ discharged.
		59.2	The thirteen (13) certificates (details as per Annexure-III to SCC), as per the proforma enclosed in Section VII (Forms and Procedures), shall be issued by the 'concerned departments of Employer'/ 'Contractor', as applicable, and submitted to the concerned authority designated in Employer for closing of Contracts.
		59.3	Both the Contractor and the Employer will make necessary efforts to complete the Contract Closing activities as per the timelines as mentioned at clause 59.2 above. It shall be the responsibility of the contractor to submit the drawings along with the reproducible, QA documents, O&M Manuals, List of Spares, As Built drawings, deliverables, etc., as applicable, in a timely and sequential manner so that the contract closing activities are not delayed/impeded. The Employer shall also use its best endeavors to expedite all activities leading to successful closure of the contract. The Employer will review

Clause No.		GENERAL CONDITIONS OF CONTRACT (GCC)
		and approve the documents submitted by the Contractor in a timely and expeditious manner and the approvals shall not be unreasonably withheld.
60.	Anti-Bribery and Anti-Corruption (ABAC) Policy	
		The Contractor and its employees along with its Associate/ Collaborator/ Sub-Contractors / Sub-Vendors / Consultants / Service Providers and all other persons associated with Employer in the performance of Contract shall strictly adhere to Employer's Anti-Bribery and Anti-Corruption (ABAC) Policy displayed on website https://ntpctender.ntpc.co.in/ under section 'policy docs'. The Contractor and its employees along with its Associate/ Collaborator/ Sub-Contractors / Sub-Vendors / Consultants / Service Providers and all other persons associated with Employer in the performance of Contract shall comply with all applicable laws and regulations relating to anti-corruption and anti-bribery and the ABAC Policy of Employer.

PERFORMANCE REPORT OF CONTRACTOR

GUIDELINES FOR FILLING THE FORMAT

- 1.0 The feedback shall be based on records, evidences and documents (hindrance register, DPR, monthly PRT MoM, contractor's MPR, etc). Due diligence shall be taken to capture the actual progress, hindrances, if any from the monthly progress report to be submitted by the concerned agency. As Daily Progress Report / Weekly Progress Report / Monthly Progress Report are key documents / inputs for Vendor Performance measurement. Non-submission of the aforesaid documents may also be reckoned as poor performance.
- 2.0 For measurement of contractor performance in various activities in supply, site execution etc, the Contractor shall submit quantified L-2 schedule within 3 months after scheduled completion of Basic Engg or 180 days from date of award, whichever is earlier. Based on the progress of detailed Engg, quantified L-2 shall be updated as and when required.
- 3.0 This vendor performance rating system is applicable for a particular package being executed by the vendor. If the same vendor is executing multiple packages in a project or at number of NTPC projects, the performance report shall be prepared package wise and the screening committee may then take a final view for evaluating the overall performance of the vendor before initiating action for issuance of Notice for Withholding of business dealings with the concerned contractor, in case the performance is found unsatisfactory.

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FORMAT FOR ENGG & QA SCORE

(TO BE FILLED IN BY NTPC ENGG.)

S.No.	Parameters	Max Score (A)	Act % age w.r.t. sch (B)	Marks obtained (C) = (A)x(B)
(i)	%age of “ Approval ” category drgs/ docs submitted within submission schedule.	30		
(ii)	%age of “ Information ” category drgs/ docs submitted within submission schedule.	20		
(iii)	%age of drgs/docs approved within approval schedule (in Cat-I/IV)*	20		
(iv)	%age of drgs/docs approved within approval schedule (in Cat-II/IVR)*	20		
(v)	%age of Sub-vendor proposal for items identified in “DR” category & submitted within agreed schedule (i.e. 3 months prior to schedule date of ordering identified in L2)**	10		
	TOTAL	100		

* For (iii) & (iv) above - If all drawings/documents due for approval are approved in Cat-I/IV within approval schedule, then marks allocated against (iii) & (iv) above shall be clubbed for calculation purpose.

** In case no “DR” proposal is submitted and orders are placed on already approved vendors, then full marks shall be given for calculation purpose against item (v).

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FORMAT FOR FINANCE SCORE

(TO BE FILLED IN BY NTPC PM PRT COORDINATOR ON MONTHLY BASIS DURING PRT MEETING, BASED ON DETAILS TO BE FURNISHED BY NTPC SITE P&S)

S. no	Parameters	Max Score (A)	% Rating (B)	Marks Obtained (C) = (A) *(B)
(i)	Number of instances NTPC has to issue Comfort letters to sub-vendors for getting supplies.	25		
(ii)	Number of instances vendor has requested for advance against BG from NTPC (beyond contractual provision)	25		
(iii)	Number of instances of supply delay beyond 1 month after issuance of MDCC.	25		
(iv)	Number of instances of direct supply / diversion of materials / consumables by NTPC.	25		
	TOTAL	100		

*Performance to be captured by NTPC PM PRT Coordinator on monthly basis during PRT Meeting, based on details to be furnished by site P&S.

*(No instances = 100%

Up to 1 instance = 50%

more than 1 instances = 0%).

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FORMAT FOR SUPPLY SCORE

(TO BE FILLED IN BY NTPC CONTRACTS)

S. no	Parameters	Max Score (A)	Actual % w.r.t. L2 schedule (B)	Marks Obtained (C) = (A) *(B)
(i)	Ordering of Bought out items as per approved L2 network*			
	Major Bought out items	20		
	Minor Bought out items	5		
	Number of instances of cancellation / changes of Bol orders (No instances = 100% Up to 1 instances = 50% more than 1 instances = 0%).	10		
(ii)	Supply of Main Equipment per approved L2 network	60		
(iii)	Supply of Mandatory spares as per approved L2 network	5		
	TOTAL	100		

*If Major & Minor Bought out items are not separately identified in L-2 network then both shall be clubbed into single line item with Max score of 25.

Note: Overall % of actual progress vis-à-vis L2 schedule in Col (B) shall be arrived in the following manner:

- (i) Let there be n type of Items/systems identified in L2/Quantified L2 schedule i.e. E1, E2, E3En.
- (ii) Let % progress for each type of Item/system vis-à-vis L2 schedule be %E1, %E2, %E3.....%En.
- (iii) Overall % in Col (B) = (%E1+ %E2+ %E3.....+%En)/n

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FORMAT FOR CONSTRUCTION/INSTALLATION SCORE

(TO BE FILLED IN BY NTPC SITE)

S. no	Parameters	Max Score (A)	% of actual vis-à-vis L2 schedule (B)	Marks Obtained (C)=(A) *(B)
(i)	Physical progress i.e. Installation of equipment / item, Civil works (i.e. Excavation, RCC, Piling, etc), Structural Works (i.e. Structural Fabrication, Erection, etc) as per approved L2 network	95		
(ii)	Project Management Capability and resource Management by Vendor at site. (5 Negative marks per instance)			
	Number of instances of delay due to inadequate deployment of equipment and T&P, based on record maintained in hindrance register, monthly PRT MoM, contractor's MPR, etc.	(-)5		
	Number of instances of direct payment by NTPC to Contractor's sub-vendors to expedite supplies / services / the progress of work at site affected due to strike / delay in payments to labourers.	(-)5		
(iii)	Submission of Monthly Report in specified formats.	5		
	TOTAL	100		

Details of Area-wise performance is mentioned below:

Sr No.	Activities	Scope	L2 Finish Date	Actual Completed till L2 Finish	%age Comp
1	Excavation				
2	RCC				
3	Structural / Equipment Erection				
				Avg Comp %	

Note: For Physical Progress, overall % of actual progress vis-à-vis quantified L2 schedule in Col (B) shall be arrived in the following manner (Unit of measurement shall be as per approved BBU for respective activities):

- (i) Let there be n category of works identified in L-2/Quantified L2 schedule i.e. W1, W2, W3Wn.**
- (ii) Let % progress for each category of work vis-à-vis L2 schedule be %W1, %W2, %W3.....%Wn.**
- (iii) Overall %in Col (B) = (%W1+ %W2+ %W3.....+%Wn)/n**

Note:

- All incidences shall be relevant to the current performance evaluation cycle.
- In case of delay in front (including construction drawings for civil packages and other inputs, if any) release by NTPC, measurement of delay in execution by the contractor shall be normalized proportionally.
- Contractor will have to submit monthly progress report capturing actual physical progress viv-a-vis L2 schedule and delay in hand over of front by NTPC, if any. In case of front delay the same has to be jointly signed by NTPC engineer & Vendor.

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FORMAT FOR QUALITY SCORE

(TO BE FILLED IN BY NTPC SITE)

S. no	Parameters	Max Score (A)	% Rating (B)	Marks Obtained (C)=(A) *(B)
(i)	Availability of Testing facilities (Available as per contractual requirement – 100% Not available – 0%)	25		
(ii)	Preventing recurrence of defects/complaints (up to 5 cases – 100%, Up to 10 cases – 40%, more than 10 cases – 0%)	25		
(iii)	Proper Storage & Preservation of Equipment/Material (Nil violation – 100%, Up to 1 case of violation – 40%, more than 1 cases of violation – 0%)	25		
(iv)	Deployment of Qualified Quality Officers/Manpower as per Contract (% deployment w.r.t. contractual requirement)	25		
	TOTAL	100		

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FORMAT FOR SAFETY SCORE

(TO BE FILLED IN BY NTPC SITE)

S. no	Parameters	Max Score (A)	% Rating (B)	Marks Obtained (C)=(A) *(B)
(i)	Having safety policy and approved Safety Assurance Plan (available as per requirement – 100%, Not-available – 0%)	10		
(ii)	Violation of safety requirement as per Safety Assurance Plan. (0 violation = 100% Upto 3 violations = 50% more than 3 = 0%)	20		
(iii)	No. of incidence of Fatal accidents due to contractor's negligence (0 incidence = 100% 1 incidence = 50% more than 1 cases, or multiple fatalities in one instance = 0%)	50		
(iv)	No. of incidence of Non-Fatal accidents due to contractor's negligence (0 incidence = 100% Up to 5 incidence = 50% more than 5 = 0%)	10		
(v)	Deployment of Qualified Safety Officers as per contract (% deployment w.r.t. contractual requirement)	10		
	TOTAL	100		

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FORMAT FOR CLAIMS & DISPUTE SCORE

(TO BE FILLED IN BY NTPC SITE)

S. no	Parameters	Max Score (A)	% Rating (B)	Marks Obtained (C)=(A) *(B)
(i)	No. of cases where Contractor stopped work on account of non-admittance/non settlement of claims (No case = 100% Upto 3 cases = 50% more than 3 cases = 0%)	70		
(ii)	No. of arbitration/legal cases resorted to by the Contractor (No case – 100%, otherwise 0%)	30		
	TOTAL	100		

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Overall Performance Evaluation

S.No.	Parameters	Max Score (A)	Score Obtained (B)	Weightage (C)	Max Weighted Score (D) = (A)*(C)	Weighted Score obtained (E) = (B)*(C)
(i)	Engineering & QA	100		0.20	20	
(ii)	Finance	100		0.20	20	
(iii)	Supply	100		0.20	20	
(iv)	Construction/Installation	100		0.20	20	
(v)	Quality	100		0.05	05	
(vi)	Safety	100		0.10	10	
	Claims & Disputes	100		0.05	05	
	Total			1.00	100	

Note: In case of Civil Contracts, score of Engineering & QA and Supply shall be NIL and weightage of Construction/Installation shall be 0.60.

Performance Rating

Total Weighted Score obtained	Performance Grade
Upto 50	Unsatisfactory
>50 to 70	Satisfactory
>70 to 80	Good
>80	Excellent

Annexure-B

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NTPC SAFETY RULES

FOR CONSTRUCTION AND ERECTION OF POWER PLANTS

INTRODUCTION:

NTPC Limited is a Maharatna organization taking lead in realizing the power dreams of the Nation with a vision “To be one of the World’s largest and best power utilities, Powering India’s growth”. Safety is one of the prime concerns of NTPC and it always strives towards accident free construction, erection, commissioning, operation and maintenance of its power projects. In this process, NTPC has already formulated Safety policy and guidelines for smooth execution of all its project activities.

In order to strengthen the existing Safety Rules for Construction and Erection and thereby curbing the chances of accidents in Construction & Erection works at various projects of NTPC, the existing safety rules have been revised for strict implementation. These Safety Rules lay down the safety requirements for safe execution of project activities, responsibilities of the contracting agencies, and all concerned involved in Construction and Erection.

A. RESPONSIBILITIES OF CONTRACTORS FOR IMPLEMENTATION OF SAFETY RULES:

The Safety Rules for Construction & Erection as outlined hereunder, while setting out a broad parameter of safety norms, are not exhaustive. The contractor and his agencies are advised to refer to the following statutory provisions as amended from time to time for details and strict compliance therewith.

FOR GREENFIELD PROJECTS:

- (a) Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996 (briefly referred to as BOCW Act),
- (b) Building and other construction workers (regulation of employment and conditions of service) Central Rules, 1998 (briefly referred to as BOCW Rules) as adopted by the various State Governments,

FOR EXPANSION, MODIFICATION, ALTERATION AND, OR CONSTRUCTION ACTIVITY WITHIN AN EXISTING PLANT OPERATING AS PER APPROVED SITE PLAN UNDER THE FACTORIES ACT;

- (a) Factories Act, 1948,
- (b) Factories Rules, as adopted by the various State Governments
- (c) BOCW Act
- (d) BOCW Rules

The contractor is also required to ensure compliance with all the relevant Acts/Rules in addition to above.

It shall be incumbent on the contractor to ensure that the requirements of safety, statutory or otherwise specified, are fully met. Thus the onus of implementation of the norms so prescribed shall squarely rest with the contractor concerned or, on his behalf, his sub-contractor or any other agency deployed by him, indemnifying NTPC from all the liabilities that may arise out of any failure to comply with the above mentioned Acts/Rules or any contravention thereof by the contractor or any other sub-agency on his behalf.

Safety cannot be ensured solely through Rules and Regulations or Codes. It is the responsibility of the Contracting Agency to ensure that basic safety principles are incorporated in the planning stage of their mobilization, execution, installation of machines, equipment, storage, etc., and initiate and maintain *safety programs*. It is desirable to have a planned programme and secure adequate cooperation of senior management, EICs, sub-contracting agencies, supervisory personnel and workers involved to ensure the implementation of the provisions of these Rules in true spirit so as to achieve the ultimate goal of *accident prevention*.

It shall also be the responsibility of the contracting agency to provide amenities and safety requirements on each construction job in order to reduce or to eliminate hazards of construction activities and also to provide necessary *first aid* facilities as well as Ambulance van (in case of major agencies) for prompt transportation of injured persons to a physician or hospital.

It is also mandated that the authorized representative of NTPC, namely, the Engineer-in-charge, may, at his convenience, exercise such superintendence, supervision and, or control as may be deemed necessary, but this shall not absolve the contractor of his basic responsibility for strict compliance with the norms, standards and, or legal provisions as applicable under the Factories Act/Rules and the Building and other construction (regulation of employment and conditions of service) Act/Rules.

Section wise checklist of provisions of BOCW Act/Rules is given hereunder for ready reference of the contractor. (This list has been prepared in chronological order with primary importance to Section of Act and secondary importance to Rules)

S - Refers relevant Sections in BOCWA

R - Refers relevant Rules in BOCWR

Sl. No.	ITEMS	RELEVANT SECTIONS / RULES IN BOCWA AND BOCWR AND RBOCWR
1	Registration of establishment	S – 7, R – 23 to 27
2.	Display of registration certification at workplace	R – 26 (5)
3.	Hours of work	S – 28 R – 234 to 237
4.	Register of overtime	S – 28; S – 29 R – 241(1) Form XXII
5.	Weekly rest and payment at rest	R – 235
6.	Night shift	R – 236
7.	Maintenance of workers registers and records	S – 30 R – 238
8.	Notice of commencement and completion	S – 46 R – 239
9.	Register of persons employed as building workers	R – 240
10.	Muster roll and wages register	R – 241(1) (a); Form XVI and XVII
11.	Payment of wages	R – 248
12.	Display of notice of wages regarding	R – 249
13.	Register of damage or loss	R – 241(1)(a); Form XIX, XX, XXI
14.	Issue of wages book	R – 241(2)(a); Form XXIII
15.	Service certificate for each workers	R – 241(2)(b); Form XXIV
16.	Display an abstract of BOCWA and BOCWR	R – 241(5)
17.	Annual return	R – 242; Form XXV
18.	Drinking water	S – 32
19.	Latrines and Urinals	S – 33 R - 243
20.	Accommodation	S – 34
21.	Creches	S – 35
22.	First-aid boxes	S – 36 R – 231 and Schedule III
23.	Canteens	S – 37 R – 244
24.	Food stuff and other items served in the canteens	R – 245
25.	Supply of tea and snacks in work place	R – 246
26.	Food charges on no loss no profit basis	R - 247
27.	Delhi BOCW welfare Board Rules	R – 250 to 296
28.	Safety committee	S – 38 R – 208

29.	Safety officer	S – 38 R – 209 and Schedule VII
30.	Reporting of accidents and dangerous occurrences	S – 39,R – 210
31.	Procedure for inquiry in to the causes of accidents	R – 211
32.	Responsibility of employer	S - 44 R – 5
33.	Responsibility of Architects, Project engineer and Designers	R – 6
34.	Responsibility of workmen	R – 8
35.	Responsibility for payment of wages and compensation	S – 45
36.	Penalties and Procedures	S – 47; S – 55
37.	Excessive noise, vibration etc.	R – 34
38.	Fire Protection	R – 35
39.	Emergency action plan	R – 36
40.	Fencing of motors	R – 37
41.	Lifting of carrying of excessive weight	R – 38
42.	Health, Safety and Environmental Policy	R – 39
43.	Dangerous and Harmful Environment	R – 40
44.	Overhead protection	R – 41
45.	Slipping, Tripping, Cutting, Drowning and Falling Hazards	R – 42
46.	Dust, Gases, Fumes, etc.	R – 43
47.	Corrosive substance	R – 49
48.	Eye Protection	R – 45
49.	Head Protection and other protection apparel	R – 46; R – 54
50.	Electrical Hazards	R – 47
51.	Vehicular traffic	R – 48
52.	Stability of structure	R – 49
53.	Illumination	R – 50; R – 124
54.	Stacking of materials	R – 51
55.	Disposal of debris	R – 52
56.	Numbering and marking of floors	R – 53
57.	Lifting appliances and gears	R – 55 to 81
58.	Runways and Ramps	R – 82 to 85
59.	Working on or adjacent to water	R – 86 & 87

60.	Transport and earthmoving equipment's	R – 88 to 95
61.	Concrete work	R – 96 to 107
62.	Demolition	R – 108 to 118
63.	Excavation and Tunneling works	R – 119 to 168
64.	Ventilation	R – 153
65.	Construction, repair and maintenance of step roof	R – 169 to 171
66.	Ladders and Step ladders	R – 172 to 174
67.	Catch platform and hoardings, chutes, safety belts and nets	R – 175 to 180
68.	Structural frame and formworks	R – 181 to 185
69.	Stacking and unstacking	R – 186 & 187
70.	Scaffold	R – 188 to 205
71.	Cofferdams and Caissons	R – 206 to 211
72.	Explosives	R – 212 & 213
73.	Piling	R – 214 to 222
74.	Medical Examination for building and other construction worker, Crane operator an Transport vehicle drivers	R – 81; R – 223(a)(iii) and Schedule
75.	Medical examination for occupational health hazards	R – 233(a)(iv)
76.	Charging of workers for Medical Examination	R – 223(b)
77.	Occupational health centres and Medical officers	R – 225 and Schedule X & XI
78.	Ambulance van & room	R – 226 & 227 and Schedule IV & V
79.	Stretchers	R – 228
80.	Occupational health service for building workers	R – 229
81.	Medical examination for occupational health hazards	R – 223(a)(iv)
82.	Emergency care services and emergency treatment	R – 232
83.	Panel of experts and agencies	Central Rule 250
84.	Power of inspectors	Central rule 251

B. RESPONSIBILITIES AND DUTIES OF WORKERS

- (a) It shall be the responsibility of the worker to comply with the requirements of safety as laid down for him and the group of workers to which he belongs and fully cooperate in the discharge of the responsibility that has been assigned to the contractor.
- (b) If he discovers any defects in the lifting appliance, lifting gear, lifting device or those concerning any transport equipment or other construction equipment or tools as well as the physical work conditions, he will report such defects promptly to his employer or NTPC Engineer or other person in authority;
- (c) No building worker shall, unless duly authorized or in case of absolute necessity, remove or interfere with any fencing, guards, gangways, gear, ladder, hatch covering, life saving appliances, lighting or other things whatsoever required and provided for safety and health. If any of the aforesaid things is removed, the persons engaged in the work shall restore such thing at the end of the period during which its removal was necessary;
- (d) Every worker shall use only means of access provided in accordance with the approved norms and no person shall authorize or order another to use such means of access or method other than those approved;
- (e) Workers shall use such means of access and egress for going to and exiting from the workplace as provided.

SECTION - I

SAFETY MANAGEMENT

1.0 SAFETY MANUAL AND SAFETY POLICY:

- 1.1** The Safety policy of the contracting agency should reflect the commitment of the concerned agency towards safety and health of the workers specified for the particular site.
- 1.2** The Contractor shall have Safety Plan detailing the safety norms evolved through Safety Policy and Job Safety Analysis (JSA) or Hazard Identification & Risk Assessment (HIRA) of all package activities and constitute a Safety management program. Contracts shall also ensure POWRA (point of work risk assessment) before start of any activity.
- 1.3** The safety management programme in the form of Safety Manual shall give details of provisions proposed by the agency w.r.t. Job Safety Analysis (JSA) or Hazard Identification and Risk Assessment (HIRA) to ensure safety of the employees and elimination of health hazards. The Safety Manual including safety policy duly signed by the head/senior executive of the agency shall be submitted to the concerned Engineer-Incharge(EIC), NTPC before start of their project activities at site.
- 1.4** Each contracting agency shall have facilities for conducting the above safety management programme, commensurate with magnitude of the work under contract.

2.0 APPOINTMENT OF SAFETY OFFICER/SAFETY SUPERVISOR:

- 2.1** Each contracting Agency shall provide a sufficient number of qualified, suitable and experienced persons to manage all safety related matter on Site relating to the works. Irrespective of manpower employed by the agency whether temporary, casual, probationer, regular or permanent or on contract, Agency shall deploy a qualified Safety Officer/executive, responsible for carrying out the safety management programme before start of the work.
- 2.2** The safety officer shall create an organization, commensurate with the project activities, consisting of other staff as required for suitable deployment.
- 2.3** The schedule of requirement of safety personnel is given below.

No. of Workers	No. of Safety Supervisors	No. of Safety Officers
Up to 100	1	1
101 to 250	2	1
251 to 500	4	1
501 to 1000	6	2
1000 to 2000	6+ One additional supervisor up to every additional 250 workers	3
2000-3000	10+ One additional supervisor up to every additional 250 workers	4
3000-4000	14+ One additional supervisor up to every additional 250 workers	5
Above 4000	18 + One additional supervisor up to every additional 250 workers	5 + one safety officer up to addition 1000 workers

2.4 The qualification and experience of the safety personnel should meet the following criteria.

- a) Safety Supervisor: (i) Possesses recognized degree in any branch of Engineering. OR
(ii) Diploma in any branch of Engineering with at least one year construction experience.
- b) Safety Officer/Safety Executive: Qualification as given under BOCW Act/rules and minimum experience of three years.

2.5 In case contractor fails to employ the required safety professionals, the department may at the cost and risk of the contractor deploy additional/required safety professionals. The cost incurred towards this shall be deducted from contractor's bill at following the rates or actual whichever is higher.

- 1. Safety Engineer Rs. 1500/day.
- 2. Safety Supervisor Rs. 1000/day.

3.0 MEETING FOR SAFETY AFTER AWARD OF THE CONTRACT:

Representatives of contracting agency along with safety Officer/executive shall meet the concerned EIC of the particular activity prior to start of construction activities for the purpose of discussing safety standards and requirements applicable to the work under contract. The person representing the agency should be a responsible person for all their site activities.

4.0 PERSONAL PROTECTIVE EQUIPMENT:

4.1 The contracting agency should ensure sufficient inventory of personal protective equipment (PPEs) prior to initial mobilization as specified in the Bidding Documents. After identifying the need of the required PPEs for various activities performed at the site, an additional inventory of approx. 20% of required PPEs should be maintain during the execution of the work. A PPE plan shall be prepared which gives fair idea regarding issue of PPEs to various personnel as per the following 'PPE Selection Matrix'.

4.2 Mandatory PPEs: Wearing of Safety Helmet, Safety Shoes and reflective jacket is mandatory for all work at site and it should be ensured that all employees and project visiting personnel shall invariably wear safety helmet, safety shoes & reflective jacket.

PPE Matrix (apart from mandatory PPEs, i.e., Safety Helmet & Safety Shoes)

Activity	Type of Protection						Remarks, if any
	Hand	Eye	Ear	Body	Respiratory	Others	
Gas Welding & Cutting	LG	WG	-	LA	*SCBA/ OLBA	-	* for confined space
Electric Arc Welding	LG	HMWS	-	LA	*SCBA/ OLBA	-	* for confined space

Rigging	CG	SG	-				--
Working at Height	-	SG	-	DLFBH	-	*FAS	* for vertical columns
Grinding & Chipping	CG	FS / SG	-	LA	-	-	--
Working in High Noise	-	-	EP / EM	-	-	-	--
Handling of Cement Concrete	RG	SG	-	-	DM	-	
Blasting	CG	SG	EP*	-	-	-	* at noise area
Excavation	CG	SG	-	-	DM	-	*Gum boot in place of Safety shoe for foot
Chemical Handling	PVCG	CSG	-	PVCA	-	-	*Full body rubber suit with hood
Electrical and C&I	ERG*	SG	-	-	-	-	*For high voltages
Sand/shot blasting	CG	-	EP/EM	CA	SAMH	-	

ABBREVIATIONS: FS: Face Shield, CSG: Chemical splash goggles, HMWS: Helmet mounted welder's shield, GB: gum boot, DLFBH: Double lanyard full body harness, SG: Safety goggles, DM: Dust mask, SAMH L Supplied air mask/hood, EP/EM: Ear plug/Ear Muff, CG: Cotton hand gloves, LG: Leather hand gloves, LA: Leather apron, RG: Rubber gloves, PVCG: PVC Gloves, PVCA: PVC Apron, SCBA: Self-contained breathing apparatus, WG: Welding goggles, ERG: Electrical Rubber Gloves. OLBA : Online breathing apparatus

4.3 The above-mentioned PPEs should be made available with contractor at site and issued to the concerned workers on the day of employment. All PPEs shall comply with ISI standards with valid test certificates.

4.4 At least two breathing apparatus sets (complying requirement as per IS: 10245) shall be provided at each site where excavation/tunneling works and Welding/ Cutting operations in confined areas are being carried out, to rescue the victims under exposure to harmful gases/vapors, if any.

5.0 SAFETY COMMITTEE:

- 5.1** *Safety committee* shall be formed within each contracting agency comprising of worker representatives with equal no. of management representatives as per the provisions of BOCW Act/rules. This committee in each agency shall meet at least once in every month. The safety officer of the concerned agency shall coordinate these meetings. NTPC Safety officer shall be special invitee for Safety Committee meetings. The safety committee functioning shall be in line with the provisions of BOCW Act/Rules.
- 5.2** Apart from the above, each agency shall organize safety meetings every day before start of day's work to educate & motivate the workers about the necessity of safety. Case study of accident/ incident can be shared in these meetings.
- 5.3** The contractor shall also regularly organize safety meetings for all job supervisors/foremen.
- 5.4** Weekly meeting with agencies' Safety Officers to be organized by safety department of NTPC and minutes to be recorded, circulated and compliance status to be checked on regular basis.

6.0 SAFETY MESSAGE PROPAGATION:

- 6.1** Contracting agencies shall arrange for display of safety hoardings depicting suitable safety cartoons/messages/ cautionary notices at appropriate places of project site to remind the workers to perform their duties safely. Minimum one safety message board/hoarding of appropriate size for every 10 workers to be provided and maintained by the concerned agency.
- 6.2** Apart from safety hoardings, each agency should maintain a safety bulletin board at all their work locations. Such safety bulletin boards should depict the activities being planned for the day, good practices, permit details etc.
- 6.3** Safety suggestion boxes shall be kept at each contractor's office at site for obtaining safety suggestions from the workers. Best suggestions should be implemented and may be rewarded suitably to encourage the workers for safety.

7. COMPETENCY OF EMPLOYEES:

- 7.1** Throughout the course of the contract, persons employed by agency shall be physically fit, qualified/experienced to perform their assigned duties/ jobs.
- 7.2** Employees shall not, knowingly be permitted to work in a manner that their ability or alertness is so impaired because of fatigue, illness or any other reason, that it may expose them and or others to injury.
- 7.3** No worker, vehicle operator shall be less than 18 years of age. And the vehicle operator shall have a valid license as per requirements of Motor Vehicle Act.
- 7.4** Contractor shall comply with all applicable state/central laws and codes related to employment of operators for Hoist, Shovel, Crane, Tractor, Bull-dozer, any other howling heavy equipment/vehicle.

8.0 SAFETY INDUCTION AND TRAINING :

- 8.1** Each worker deployed by the agency shall be given 2-days induction training which shall include the medical examination and instructions related to particular job, fire fighting, first-aid and reporting of accidents. All employees shall be given safety training as per BOCW Act/Rules.
- 8.2** The contracting agency shall also impart job specific skill based safety training to all its employees (Minimum one day) on various related safety topics using internal/external safety professionals/consultants as per the matrix given below. Record of such trainings and attendance particulars shall be maintained in a register for ready reference to statutory authorities/engineer-in charge.

TRAINING MATRIX:

Name of topic	Executives	Super visors	Skilled Workmen	Other Workers
Safety Induction	Y	Y	Y	Y
Accident_ Causes, factors, cost	Y	Y	Y	-
Industrial hazards & Accident Prevention	Y	Y	Y	-
Investigating, reporting, records	Y	Y	-	-
Personal Protective Equipment	-	Y	Y	Y
Construction Safety & Role of Supervisory personnel	-	Y	-	-
Permit to Work (PTW)	-	Y	Y	y
Statutory Provisions (BOCW Act/Rules, Factories Act 1948 etc.)	Y	Y	y	y
Material handling	-	y	Y	Y
Emergency Management	Y	Y	Y	-
Electrical Safety	-	Y	Y	-
Fire safety	Y	Y	Y	Y
First Aid & CPR (cardio pulmonary resuscitation)	-	Y	Y	Y (Selected)
Safety in Welding & Cutting	-	-	Y	-
Safety Audit	Y	Y	-	-
Safety in Lifting Tools & Tackles	-	Y	Y	y
Safety in Working at height	-	Y	Y	Y
Safety in Confined space work	-	Y	Y	Y
Defensive Driving	-	Y*	Y*	Y*

*for construction vehicle operators, helpers & crane operators

Y=Yes

9.0 ID PASS

- 9.1** CLIMS (Contract Labor Information Management System) will be the criterion for entering or gate pass system if implemented at site.
- 9.2** The contractor shall ensure that all personnel working at site having a photo Identity card before they are engaged for any work and properly mentioned details like validity, Category/designation and work area etc. This ID card should be issued only after ensuring their screening test, medical fitness and safety induction training. Id card gate pass shall be indicated with 3 nos. of offence marks. With each offence the gate pass of concerned workmen/ supervisor will be punched giving on the spot indication of persons indulging in unsafe actions.
- 9.3** Drinking of Alcoholic beverages is strictly prohibited. Employees under the influence of any intoxicants, even to the slightest degree, shall not be permitted to remain at work. Each contractor should maintain 'breath analyzer' to determine the intoxicated workers at site.

10 SAFETY AUDIT

- 10.1** Internal Safety Audit once in every six months by the contracting agency and external safety audit as once in a year by third party shall be conducted, with prior intimation to EIC and NTPC Safety Deptt. The external auditing agency should be reputed safety institution or a certified Safety Auditor under any statutory legislation. The audit report along with time bound action plan should be submitted to Engineer-in-charge and NTPC Safety Dept.
- 10.2** Apart from above, Electrical Safety Audit shall be conducted quarterly by a team comprising of Electrical engineer, Safety representative of contractor and NTPC Electrical Erection representative covering the following and submit the report to EIC.
- i) Electrical incidents investigation findings and remedial measures implemented.
 - ii) Adequacy of power supply requirements
 - iii) Power distribution system in place
 - iv) Updated electrical single line diagram including the IP44 DBs arrangement.
 - v) Electrical protection devices – ELCBs, O/L protections etc.
 - vi) Earth or ground connection and earth pit maintenance details
 - vii) Education and training of electrical personnel undertaken
 - viii) Any other point appropriate to the site conditions.

11. SAFETY BUDGET

Every contracting agency should clearly estimate and allocate a separate budget head for safety requirements every year and make the safety activity plan for the year and submit to NTPC EIC & Head of Safety. Budget allocations should be practically adequate to the site safety requirements and the details shall be intimated to the concerned EIC and safety deptt. before start of the work under the contract and subsequently, every year by 15th of April. Engineer-in Charge in consultation with Head of Safety shall review and monitor the effective utilization of allocated budget for safety related activities by the Contractor.

12. REPORTING AND INVESTIGATION OF ACCIDENTS AND DANGEROUS OCCURRENCES:

12.1 Reporting of accidents: Notice of any accident (the prescribed format is annexed to the manual) to a worker at the building or construction site that

- (a) Causes loss of life; or
- (b) Disables a worker from working for a period of **48 hours** or more immediately following the accident;

Shall forthwith be sent by Telegram, Telephone, Fax, Email or similar other means including special Messenger within **four hours** in case of **fatal accidents** and **72 hours** in case of **other accidents**, besides the Engineer-in-charge, to:

- I. The Regional Labour Commissioner (Central);
- II. The Board with which the worker involved was registered as a beneficiary;
- III. Director General of Building and other construction (regulation of employment and conditions of service) Act/Rules; and
- IV. The next of kin or other relative of the worker involved in the accident;

12.2 Further, notice of accident shall be sent in respect of an accident which

- (a) Causes loss of life; or
- (b) Disables the injured worker from work for more than 10 days to
 - (1) The Officer-in-charge of the nearest Police Station;
 - (2) The District Magistrate or, if the District Magistrate by order so desires, to
 - (3) The Sub-Divisional Magistrate;

12.3 Where any accident causing **disablement that subsequently results in death**, notice thereof in writing of such death, shall be sent the Authorities mentioned above within **72 hours** of such death.

12.4 In case of an accident causing minor injury, first-aid shall be administered and that resulting in disability of **48 hours or more**, the injured worker shall be given first-aid and immediately transferred to a Hospital or other place for medical treatment.

12.5 All near-miss accidents shall be reported to NTPC Engineer In-charge and Safety Officer as per prescribed format.

12.6 Reporting of dangerous occurrences: The following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any disablement or death caused to the worker, namely:

- (a) Collapse or failure of lifting appliances, or hoist, or conveyors, or similar equipment for handling of building or construction material or breakage or failure of rope, chain or loose gears; or overturning of cranes used in construction work;
- (b) Falling of objects from height;
- (c) Collapse or subsidence of soil, any wall, floor, gallery, roof or any other part of any structure, platform, staging, scaffolding or means of access including formwork;
- (d) Contract work, excavation, collapse of transmission;
- (e) Explosion of receiver or vessel used for storage at a pressure than atmospheric pressure, of any gases or any liquid or solid used as building material;

- (f) Fire and explosion causing damage to any place on construction site where building workers are employed;
- (g) Spillage or leakage of any hazardous substance and damage to their container;
- (h) Collapse, capsizing, toppling or collision of transport equipment;
- (i) Leakage or release of harmful toxic gases at the construction site;
- (j) In case of failure of a lifting appliance, loose gear, hoist or building and other construction work, machinery and transport equipment at a construction site, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the Authorities;

12.7 Every notice given for fatal accidents shall be followed by a written report to the concerned Statutory Authorities and the Engineer In-charge in the specified Form annexed as Schedule, under acknowledgement.

12.8 Incident / injury statistics shall be maintained by all agencies cause wise.

12.9 Investigation of accidents and dangerous occurrences

Besides reporting, it shall be the responsibility of the contractor to constitute a team (members as per the gravity of the incident) of responsible person to thoroughly investigate all incidents involving near-miss accidents, lost-time and reportable accidents and dangerous occurrences with a view to finding out the causative factor, taking remedial measures and fixing responsibility, and make a copy of the investigation report along with action-plan, specifying a definite time-frame for implementation of the findings, available to the Engineer in-charge forthwith.

13. MEDICAL AND FIRST AID AMENITIES:

13.1 It is the responsibility of each contracting agency to ensure the availability of suitable arrangements at their work site for rendering prompt and efficient First aid to injured persons.

13.2 Arrange one trained and certified first aid for every twenty workers in each shift.

13.3 Ambulance with proper equipment for prompt transportation of the injured persons to a physician or a hospital shall be provided before start of the work in cases where 500 or more than 500 workers are employed. For smaller contracts, where less than 500 workers are employed, Contractor shall have a tie-up with suitable Agency for providing Ambulance with proper equipment for prompt transportation of the injured persons to a physician or a hospital in case of an Accident / Emergency. Further, Contractor shall submit a proof of the same to EIC/Safety Officer of NTPC.

13.4 Deploy one full time construction medical officer (qualification as per Schedule XI of BOCW Central Rules -1998) for cases where 500 or more workers are employed (upto one thousand workers) and one additional construction medical officer for additional one thousand workers or part thereof. For smaller contracts, where less than 500 workers are employed, Contractor shall have a tie-up with suitable Hospital / Nursing home in the vicinity of the

Project/Site where work is being executed, for providing adequate medical treatment by qualified medical officers and nursing staff, as and when required. Further, Contractor shall submit a proof of the same to EIC/Safety Officer of NTPC.

Notwithstanding anything stated above, Contractor/Agency shall strictly comply with the requirements of relevant BOCW Act/ BOCW Rules/ Factory Act/Factory Rules/ any other statutory Act/Rules/Law with regards to providing suitable medical facilities to the workers.

In case contractor fails to employ the required construction medical officer alongwith Additional staff, corresponding payment for the same shall not be made and/or necessary action as per provisions of the Bidding documents shall be taken by NTPC.

- 13.5** Additional staff including one nurse, one dresser-cum compounder, one sweeper-cum-ward boy with each construction medical officer for full working hours
- 13.6** The Telephone nos. of Medical officer, Hospital(s) or ambulance shall also be conspicuously displayed at each work site.
- 13.7** First-aid kits as approved by medical officer shall be provided at accessible points in the ratio of at least one kit for every 50 employees.
- 13.8 Health Management:** The site manager shall implement health examinations for the working personnel on a regular basis.

Types of health examination	Target	Frequency
General health examination	All workers	Annual
Occupational health examination (Audiometric, PFT, Vision etc.)	Worker engaging in noise, dust, vibration, harmful light generating work	Annual
Occupational health examination (Vision)	Personnel involved in operation of Cranes, heavy vehicles	Annual
Occupational health examination (Vertigo/Height pass)	Workers engaged at Height Works	At the time of induction training and every year

14. TESTING & EXAMINATION OF LIFTING, TOOLS, TACKLES, PRESSURE VESSELS AND OTHER EQUIPMENT:

- 14.1** All the lifting equipment, tools, tackles, pressure vessels etc. shall be tested & examined as per BOCW or Factories Act and rules made there under.

- 14.2** The records & certificates of such testing & examination shall be maintained and readily available for reference to statutory authorities/engineer-in-charge.
- 14.3** Proper color coding system should be maintained and marking should be done accordingly on all lifting tackles.
- 14.4** Regular testing of ELCBs and RCCBs by competent electrician must be ensured by agencies and record should be maintained.

15. EMERGENCY MANAGEMENT PLAN

- 15.1** The contractor shall ensure that an Emergency Management Plan is prepared to deal with emergencies arising out of:
 - a. Fire and explosion;
 - b. Collapse of lifting appliances and transport equipment;
 - c. Collapse of building, sheds or structure etc.;
 - d. Gas leakage or spillage of dangerous goods or chemicals;
 - e. Drowning of workers, sinking vessels, and
 - f. Landslides getting workers buried; floods, storms and other natural calamities.
- 15.2** While arrangements shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the contractor with their telephone numbers and addresses for quick communication shall be adequately publicized and conspicuously displayed in the workplace.
- 15.3** It is also required that there is a tie-up with the hospitals and fire stations located in the neighborhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.
- 15.4** It shall be the responsibility of the contractor to keep the Local Law & Order Authorities informed and seek urgent help, as the case may be, so as to mitigate the consequences of an emergency. Prompt communication to NTPC, telephonically initially and followed by a written report, shall be made by the contractor.

16. ENFORCEMENT OF SAFETY CODE, SAFETY RULES & REGULATIONS:

The Engineer-In charge shall ensure that the contractor is exercising at all times, reasonable and proper precautions for the safety of people at works and complying with the provisions of current safety rules and laws according to safety code and relevant statutes of state/central governments. In case of negligence or default, the agency shall be penalized suitably as per penal provisions of NTPC Safety Rules.

17. WORK PERMIT SYSTEM

- 17.1** The Contractor shall implement Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form an essential part of safe systems of work for many construction activities. They start the work

only after safe procedures have been defined and clearance taken from respective NTPC EICs. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments.

17.2 Examples of high-risk activities include but are not limited to:

- i) Entry into confined spaces
- ii) Cutting & welding
- iii) Working at Height along with checklist
- iv) Working on electrical equipment
- v) Heavy lifting operations
- vi) Removal of grating/ Handrail / floor opening
- vii) Material Shifting

The copies of recommended formats for reference is given in annexure-IV.

17.3 The permit-to-work system should be fully documented, laying down:

- i) How the system works
- ii) The jobs it is to be used for;
- iii) The responsibilities and training of those involved; and
- iv) How to check its operation;

17.4 A Work Permit authorization form shall be completed with the maximum duration period not exceeding 12 hours.

17.5 A copy of each Permit to Work (PTW) shall be displayed near to work area (on PTW Display board) in close proximity to the actual works location to which it applies.

18. ACCESS TO AND FROM THE WORKPLACE

18.1 Safe, clean, well lit, unencumbered access and egress to and from work areas shall be maintained at all times in normal operating conditions.

18.2 The number and location of accesses and egresses from and to the workplace shall be adapted to the number of people likely to be present at any time, and therefore to evacuate from the workplace in case of emergency.

18.3 If access and egress to work areas are restricted due to operational conditions (e.g. access restricted due to pressure testing, etc.), alternative access and egress ways must be implemented, so far as is reasonably practicable. If this is not reasonably practicable, all concerned organizations and persons must be informed of the access restrictions, and work scheduling must be adapted in consequence.

18.4 Temporary access to height or into ground openings shall be of purpose made material such as scaffolds, stair cases/towers and ramps, which incorporate guardrails .

19. INTERFERENCE WITH MOVING VEHICLES AND PEDESTRIANS

- 19.1** The circulation of vehicles and pedestrians must be segregated by establishing restricted areas, one way routes where possible, pedestrian crossing zones and designated parking areas.
- 19.2** The appropriate measures must be implemented in order to prevent collision between pedestrians and vehicles at pedestrian crossings. This may include, but shall not be limited to:
 - Mirrors;
 - Lighting;
 - Speed bumps before the crossing point.
- 19.3** Vehicle and pedestrian ways shall be physically separated with Hard-barriers, so far as is reasonably practicable, and be indicated with signs.



- 19.4** When it is not reasonably practical to implement a physical segregation, pedestrians must maintain safety distance of at least 2 meters from moving/operating vehicles at all times.
- 19.5** Traffic rules must be made visible through signage and traffic stops, consistent with those used on public
- 19.6** Roads as per road safety requirement.
- 19.7** All pedestrians on Project sites must wear high-visibility garments.
- 19.8** Pedestrians (including banksmen) must wear high-visibility garments in all areas where trucks and other vehicles (forklifts, cranes, etc.) maneuver. These areas must be clearly signaled / marked (floor painting, Hard-barriers, signs, etc.).Additional points:
- 19.9** Competent banksmen must be used for operations involving reversing or maneuvering where space or view is restricted.
- 19.10** Drivers must only operate vehicles they are competent to drive and must follow the established traffic routes and comply with all site rules.
- 19.11** The maximum driving speed on site is 15 km per hour.
- 19.12** Drivers and passengers must not get on or off moving vehicles.
- 19.13** When driving a forklift, forks must be lowered, the mast tilted back.
- 19.14** Smoking, eating, drinking, using a mobile phone or using earbuds or headphones when driving a vehicle is strictly prohibited.
- 19.15** When the vehicle is not in use, it must be ensured that:
 - The engine is stopped and prevented from unauthorized use (e.g.: starter key removed), brake applied (and with wheels chocked for heavy vehicles);
 - All raised parts are lowered to the ground or put in a safe position (cranes);
 - It does not obstruct emergency exits, other routes, fire equipment or electricity panels.

20. HOUSEKEEPING

The contractor shall ensure that their work area is kept clean, tidy and free from debris generated by their activities. All debris/scrap should be stored in separate bins. The work areas must be cleaned on a daily basis and a full cleaning session of each area shall be conducted on a weekly basis. All equipment, materials and vehicles shall be stored in an orderly manner. Access to emergency equipment, exits, telephones, safety showers, eye wash stations, fire extinguishers, pull boxes, fire hoses, etc. shall not be blocked or otherwise disturbed, restricted or delayed.

21. STACKING AND STORAGE PRACTICE

Contractor Agency shall ensure stacked material is bonded on a stable and level footing capable of carrying the mass of the stack. Adequate clearances shall be provided between the sides of the stack and top to facilitate unimpeded access to service equipment like overhead wiring, cranes, forklifts and firefighting equipment, and hoses. Circular items shall be sufficiently choked with wedges not with odd bits of materials. Free-standing stacks of gunny bags and sacks such as Cement bags shall be stacked to prescribe safe stacking heights with layers formed for stable bonding, preventing slippage causing accidents. Stacking against walls shall not be permissible.

Contractor shall maintain the premises and surrounding areas in clean and clear manner with safe access and egress. There shall be sufficient and adequate storage racks, shelving, bins and pallets and material handling equipment to stack his construction materials such as Pipes, Structural and his construction enabling materials. Unwanted materials shall be promptly moved away for efficient material movement.

Any temporary store shed will be built in conformity with fire safety requirements. The stores must be provided with adequate lighting arrangement (Flame proof / intrinsically safe depending upon the Zone category) and must be equipped with sufficient fire extinguishing arrangement. "No Smoking" and other relevant signage must be displayed conspicuously at strategic locations and safety precautions must be strictly enforced.

All material should be kept at least 150mm above from the ground by providing wooden packing below. Maximum height of material stacking should not be greater than 3 meter. All loose material must be kept in wooden box or in sharp edge protected drum and material identification details to be displayed. Materials inside store room should be kept on scaffold rack.

Gas cylinder storage area must be 30m away from the hot work zone and separate storage facility must be available for empty and full cylinder with proper shed. Storage area must be design in a way that 6 meter distance between LPG/DA and oxygen maintained

22. CONFINED SPACES

All Confined Spaces belonging to Subcontractor shall be identified and clearly signed posted as a confined space forbidden to unauthorized Personnel at every entrance. A method for preventing entry must be established and maintained for all Confined Spaces. Physical prevention system (such as locks) is preferred.

Before commencing work in a Confined Space, the Subcontractor must obtain a Permit to Work from the relevant authority.

The following requirements shall be met at any time:

- Only competent and trained workers can participate to work in confined spaces (as a minimum as per local Law). A Confined Space Entry Log (or equivalent) must be used to identify the person inside the Confined Space at any time;
- Air Analysis tests must be carried out to determine if the Confined Space is oxygen deficient and/or contains flammable substances, toxic agents, carbon monoxide and/or harmful physical agents. The air shall be analyzed before starting work, during work and after work. Adequate ventilation must be provided;
- Working in the confined space without a watcher is strictly forbidden. An adequate means of communication is required and shall enable easy and clear communication:
 - Between those inside the space,
 - Between those inside the space and those outside,
 - To summon help in case of emergency;
 - Adequate emergency provisions must be in place. In particular, necessary rescue equipment must be ready, pre inspected and available. The arrangements need to be suitable and sufficient for the rescue of persons in the event of an emergency.

23. FIRE PROTECTION AND PREVENTION

Routine hot works should be described in the contractor Risk Control Plan .Non-routine hot works are submitted to daily hot works permits given by the relevant authority.

Full and unrestricted access to emergency exits, fire-fighting equipment, fire control and emergency vehicles shall be maintained at all times. The Subcontractor shall provide, install and maintain their own temporary fire protection against hazards they introduce to the Site (work areas, storage areas, and temporary facilities under their responsibilities).

Fire extinguishers shall be inspected at least annually by a certified person and visually inspected monthly and documented by the Contractor.

24. ELECTRICAL SAFETY

Personal authorization must be issued by Contractor Management (or formally designed delegates) likely to perform or supervise electrical works.

Without such an authorization validated by EIC, no Contractor's employee shall undertake electrical works.

No live work on high voltage or medium voltage is allowed. All high voltage and medium voltage electrical works must be performed on isolated equipment and only after verification of absence of voltage with suitable equipment. Low voltage and very low voltage live work is only allowed for measurement tests and checks of equipment. The below measures will be taken:

- Work practices must protect against direct or indirect body contact by means of tools or materials and be suitable for work conditions and the exposed voltage level
- A Lockout and Tagout procedure must be applied prior to commencing any electrical work. Prior to commencing works on isolated equipment, a verification of absence of voltage with suitable safety test equipment must be performed.
- Energized panels will remain locked with a specific key or tool whenever they are unattended and tagged with the signs and warnings indicating the presence of danger. If not reasonably practicable, a restricted area delimited with physical barriers and supported by warning signs must be implemented around the opened equipment.
- Only qualified electrical Contractor Personnel may enter substations and/or transformer vaults and only after being specifically authorized by NTPC EIC.
- All joints (Both terminal and intermediate) in cable should be made using lugs and joint area should be crimped using crimping tools.
- All temporary connection should be provided through 30mA ELCB/RCCB using 3 core double insulated cable and only 3 pin industrial plug top will be used for connection.
- Zero energy verification needs to be ensured before any electrical operation using only VAV before working on a live circuit which has been isolated
- Only industrial type DB to be used for connection and weather protection shed needs to be provided for every DB and shed height should not be less than man height.
- Double earthing protection must be provided for every electrical equipment and earthing value should be less than 1 Ohm
- Deployment of trained, experienced & licensed electrician as well as licensed electrical supervisor must be ensured at site as per Rule-45 of the Indian Electricity Rules, 1956 ;
- EIC May perform screening/ competency test for all contractor electrical professions i.e. electrical engineers and helpers. Selection/ rejection of the personnel who appear for the screening is sole discretion of EIC
- Electrical helper who will be engaged in helping the electrician/ engineer must have minimum ITI certificate to be eligible for working with him
- All PPE' s used while being involved in electrical work must be as per IS Standards available for electrical work

25. COMPRESSED GAS CYLINDERS

Gas cylinders shall be securely stored and transported, and identified and used in line with the safety Requirements as per Gas Cylinder Rules -2106.

Hose lines shall be adequately protected, inspected and tested for leaks in line with the safety Requirements. Flash back arrestor /NRV must be used at both ends of the hoses and all hose should be free from damage and fixed properly preferably using crimping clamps. Leakage test must be done before every use by soap solution and physical inspection of hose must be carried out regularly. Only trolley attached with wheel will be used for cylinder transportation in which cylinders must be kept secured with chain. Only Industrial type regulator fitted with two stage double dial pressure gauge is allowed to be used.

26. LIFTING OPERATIONS

The Contractor shall prepare a lifting plan, checked and submit for authorization by contractor's competent authorized persons prior to any lifting operation and formally communicated to all persons undertaking the work.

All persons preparing, issuing lifting plans and all persons involved in lifting operations must be subject to formal competence checks by the contractor to ensure necessary training, experience and qualification prior to commencing work. The Subcontractor must ensure that their nominated Lifting Leader has appropriate qualifications.

Contractor lifting plans include:

The lifting methodology, step by step

The risk analysis of the operation including consideration for weather conditions and work environments (e.g.: proximity of hazards and obstructions to the load, consideration for overturning, load integrity) where appropriate and consideration for simultaneous operations and the measures taken to avoid conflicting tasks in the lifting area

The identification of the designated lifting area, the fall zone and the control measures to prevent access such as barriers, signs, etc.

The description of the type, weight, size, shape and center of gravity of the load and the method used for slinging, attaching and detaching the load with the availability of approved lifting points on load when necessary

The list of the certified and inspected equipment and lifting accessories to be used

The composition of the team required to perform the task (crane driver, rigger, etc.) with the needed qualifications and description of their roles and responsibilities including the intended communication method

Any Heavy equipment (crane, winch machine, etc.) manufactured less than 15 years from the current year shall be only allowed to be used at our project Site's. Pre-safety Inspection of the equipment by safety deptt. shall be done before mobilizing the equipment at our project site.

The contractor must ensure that a competent operational leader is formally appointed to supervise each lifting operation. All lifting plans must clearly define the specific roles and responsibilities for each person involved (e.g.: crane drivers, lifting coordinators and riggers) and must be checked and issued prior to lifting operation. Clear communication channels must be formally established and maintained between everyone involved in a lift with only authorized person giving instruction to the operator.

Special permission needs to be taken from NTPC EIC for tandem lifting and for any non-routine lifting operations must strictly adhere to the guidelines described in corresponding Standard / Procedures / Directive.

No employee of the contractor shall be positioned under a suspended load or between a suspended load and fixed objects.

All lifting equipment and accessories must have valid manufacturers certificates or thorough examination records and be uniquely identified, marked with the safe working load, listed in a register and subject to formal regular inspection as per EHS requirements and shall have valid certificates from a competent authority. Inspection before use by the operator is mandatory. All lifting hooks must have latch. All cranes shall be fitted with Automatic Safe Load Indicator (ASLI) and Anemo Meter.

The contractor shall operate and maintain cranes and hoisting equipment in accordance with manufacturers' specifications and limitations and the safety Requirements. All defective, non-inspected or unidentified (safe working load / identification number) lifting equipment or accessories must be either removed from site or physically prevented from use.

27. LOCKOUT TAGOUT (“LOTO”)

Prior to performing work on Machines or Equipment, the Subcontractor shall ensure that all energy sources are isolated and verify the absence of residual energy (e.g.: by using specific voltage detecting device for electricity).

At any time, the contractor shall follow the Site-specific LOTO and Permit to Work rules. The contractor must ensure that all of their affected Subcontractor Personnel receive the necessary training. Lockout/ Tagout must be implemented before servicing and maintenance is performed on Machines and Equipment, which could unexpectedly start-up, become energized, or release stored energy exposing persons to a risk of injury, unless the works undertaken are performed using alternative measures that provide effective protection.

Absence of residual energy must be verified using the suitable equipment or process adapted to the machine and the kind of energy to be checked before start of work. *The contractor must procure suitable VAV instrument for verification of absence of voltage before implementing LOTO all by themselves.*

When the contractor is in charge of LOTO, each authorized person must be issued with an individual lock with a unique key. The contractor shall secure areas where energy sources have been de energized, so as to prevent the access of unauthorized personnel and erect suitable signs. All affected Personnel shall be notified.

Once an item of electrical equipment has been energized, an item of mechanical plant and/or System has been erected and released for Commissioning, no work will be allowed on such item of Equipment or System unless a valid Permit to Work (PTW) has been obtained from the relevant authority.

28. MONTHLY SAFETY REPORT

Agency has to submit the monthly safety activity report in the form of Lead-Lag indicator to NTPC Safety Deptt. Sample format attached as annexure –IV.

29. In case the Contractor doesn't adhere to any of the provisions of the NTPC Safety Rules for Construction and Erection of Power Plants, corresponding payment for the provisions not adhered, shall not be made and/or necessary action as per provisions of the Bidding documents shall be taken by NTPC.

SECTION-II

1. Safety at workplace and equipment

1.0 GENERAL PROVISIONS:

1.1. Housekeeping:

- a. The contractor shall be primarily responsible for maintaining Good housekeeping and safety standards in the workplace;
- b. Loose materials that are not required for use shall not be placed or left behind so dangerously as to obstruct workplaces or passageways;
- c. All projecting nails shall be removed or bent to prevent injury;
- d. Equipment, tools and small objects shall not be left lying unattended or unsecured from where they could fall or cause a person to trip;
- e. Scrap, waste or rubbish shall not be allowed to accumulate in the site as these combustibles can create serious fire hazards and affect safe working;
- f. Workplaces and passageways that become slippery owing to spillage of oil or other causes shall be cleaned up or strewn with sand, ash or the like;
- g. Portable equipment shall be returned after use to their designated storage place.

1.2. Means of access and egress shall consist of

- a. Adequate and safe means of access and egress shall be provided in all workplaces;
- b. The means of access and egress shall be maintained in a safe condition;

1.3 Lighting and ventilation

- a. All practical measures shall be taken to prevent smoke, fumes etc. from obscuring any workplace or equipment at which any worker is engaged;
- b. Adequate and suitable artificial lighting shall be provided where natural lighting is not sufficient as per IS 3646 (Part II). The artificial lighting so provided shall not cause any incidental any danger, including that of producing glare or disturbing shadows;
- c. To prevent danger to health from air contamination by dust generated during grinding, cleaning, spraying or manipulation of materials as also to provide protection against dangerous gases, fumes, vapours, mist, etc. effective arrangements shall be made for ventilation;
- d. Workers shall be provided with suitable respiratory protective equipment, if it is not technically possible to have uncontaminated air. To this end, a study by a competent person shall be made to decide on the due protection. Sufficient illumination at all times for maintaining safe working conditions shall be provided where building workers are required to work or pass, and for passageways, stairways and landings such illuminations shall not be less a than 0.5 foot candles at the floor level;
- e. Where natural lighting is not adequate to prevent danger, adequate and suitable lighting shall be provided as per IS: 3646 – Part II;
- f. Artificial lighting shall not cause any danger due to a brightness greater than 10 foot candles per square inch, except where the angle of inclination from the eye to the source or the part pf the fitting as the case may be exceeds 20^o, including that of producing glare or disturbing shadows;
- g. Where necessary to prevent danger to health from air contamination by dust from the grinding, cleaning, spraying, or manipulating of materials or objects, arrangements shall be made to limit the concentration of the pollutants by thorough ventilation, and dust generated due to movement of earthmoving machinery and other construction equipment, by spray of water in the area from time to time;
- h. Adequate ventilation by the circulation of fresh air shall be maintained in such places where the concentration of pollutants is likely to affect the health of the workers;

- i. Special care shall be taken to ventilate the workplace where gas cutting, welding or other operations involving generation of dangerous fumes, vapours, mists, gases etc is likely;
- j. Where it is technically not possible to eliminate dust or noxious or harmful fumes or gases sufficiently to prevent injury to the health of the workers, the contractor shall provide suitable respiratory equipment like dust mask or gas/fume mask or breathing apparatus or other suitable respiratory equipment.

1.4. Dangerous and harmful environment:

- a. When an internal combustion engine exhausts into confined space or excavation or tunnel or any other workplace where neither natural ventilation nor artificial ventilation system is adequate to keep the carbon monoxide content of the atmosphere below fifty parts per million, adequate and suitable measures shall be taken at such workplace in order to avoid exposure of building workers to health hazards;
- b. No building worker shall be allowed to enter any confined space or tank or trench or excavation wherein there is given off any dust fumes or other impurities of such nature and to such extent as is likely to be injurious or offensive to the building worker or in which explosives, poisonous, noxious or gaseous material or other harmful articles have been carried or stored or in which dry ice has been used as a refrigerant, or which has been fumigated or in which there is a possibility of oxygen deficiency, unless all practical steps have been taken to remove such dust, fumes or other impurities and dangers which may be present and to prevent any further ingress thereof, from such workplace or tank or trench or excavation;
- c. No worker shall be allowed to enter any such space unless a responsible person has certified it safe and fit for the entry of such building workers.

1.5. Fumes/gases due to Welding and gas-cutting operations: When welding or cutting operations are carried out in a confined space:

- a. Adequate ventilation, by means of exhaust fans or forced draught, as the condition may require, shall be constantly provided; otherwise enough quantity of air shall be circulated by means of air compressors to dilute the contaminant within permissible limits;
- b. Workers shall take necessary precautions to prevent unburned combustible gas or oxygen from escaping inside a tank or vessel or other confined space;
- c. Welding or cutting operations on any container that has held explosives or where inflammable gases may have been generated, shall be undertaken after the container has been thoroughly cleaned by steam or other effective means; and
- d. Gas-test shall be carried out ensure that the confined space is completely free from combustible gases and vapours.

1.6. Dust, gases, fumes

- a. Concentration of dust, gases or fumes shall be prevented by providing suitable means to control their concentration within the permissible limit so that they may not cause injury or create health hazard to a building worker;

- b. For protection against such hazardous substances, besides efficient and effective means of control, personal protective equipment like dust masks, breathing apparatus, other respiratory appliances, goggles, as the case may be, shall be provided.

1.7. Excessive noise:

- a. Adequate measures shall be taken against the harmful effects of an excessive noise;
- b. Use of earplugs/muffs and anti-vibration gloves shall be ensured to protect the workers from the impact of exposure to such dangers;
- c. The noise level in no case shall exceed as prescribed in the concerned Rules and exposure in excess of 115 dBA over the period of a quarter of an hour cannot be permitted:

1.8. Corrosive substances:

- a. All corrosive substances, including alkalis and acids, shall be stored and used by a person dealing with such substances at a building or other construction work in such a manner that it does not endanger the building worker and suitable protective equipment shall be provided by the employer to a building worker during handling or use of such substances at a building or other construction work and in case of spillage of such substances on the building worker, immediate remedial measures shall be taken;
- b. While protection of the body could be ensured by use of corrosion resistant apparel/overalls, suitable goggles, gloves, apron, gum boots etc. shall be made available to all concerned personnel;
- c. To deal with an accidental spillage of a corrosive substance on the body of a worker, the facility of eyewash fountain or water shower, as the case may be, shall be installed, within the easy reach of the workplace.

1.9. Eye protection:

- a. Suitable personal protective equipment for the protection of eyes shall be provided and used by the building worker engaged in operations like welding, cutting, chipping, grinding or similar operations which may cause hazard to his eyes;
- b. Goggles or face shield or welding screen with suitable shade of glass/filters etc shall be provided for the protection of the eyes.

1.10. Overhead protection:

- a. It shall be ensured that at the building or other construction site, overhead protection is erected along the periphery of every building under construction that shall be of fifteen meters or more in height when completed;
- b. Overhead protection shall not be less than two meters wide and shall be erected at a height not more than five meters above the base of the building and the outer edge of such overhead protection shall be one hundred fifty millimeters higher than the inner edge thereof or shall be erected at an angle of not more than twenty degrees to its horizontal sloping into the building;

- c. It shall be also ensured that at the building and other construction work that any area exposed to risk of falling material, articles or objects is roped or cordoned off or otherwise suitably guarded from inadvertent entry of persons other than building workers at work in such area.

1.11. Lifting and carrying of excessive weight:

- a. No building worker lifts by hand or carries overhead or over his back or shoulders any materials, articles, tools or appliances exceeding in weight the maximum limits as set out in the following table unless aided by any other building worker or a mechanical device;
- b. No worker aided by other workers, lift by hand or carry overhead or over their back or shoulders any materials, articles, tools or other appliances exceeding in weight the sum total of the maximum limits as prescribed in the concerned Rules, unless aided by a mechanical devices:

1.12. Protections against fall of persons –

- a. All scaffolds/working platforms at height of two metres or more shall be fenced;
- b. All guard-rails for the fencing of floor openings, gangways, elevated workplaces shall be made of sound material, good construction and possess adequate strength and be between 1 m and 1.5 m above platform level, consist of two rails (two ropes or chains may be used if they are sufficiently taut) and supporting stanchions;
- c. Intermediate rails, ropes or chains shall be midway between the top and lower of edges of the top rail;
- d. Sufficient number of stanchions or standard poles or uprights shall be maintained to ensure the required stability and resistance;
- e. Guard-rails shall be free from sharp edges and be maintained in good repair;
- f. Floor openings through which persons could fall, shall be guarded by covering or fencing;
- g. If the means of protection is removed to allow the passage of persons or goods or other purpose, the same shall be replaced as soon as possible, while making temporary arrangements for reasonable degree of safety in the meanwhile;
- h. Covers for floor opening shall be safe to walk on and if vehicles operate thereon it shall be safe for the same. This will require the contractor to have prior assessment of expected loads;
- i. Cover for floor opening shall be secured by hinges, grooves, stops or other effective means against sliding, falling down or lifting out or any other inadvertent displacement;
- j. Covers for any openings shall not constitute any hindrance to traffic and, as far as practicable, be flush with the floor;
- k. If covers constitute as grids, the bars shall be spread not more than 5 cm apart;
- l. Elevated workplaces at more than 2 m above the floor or ground shall be protected on all open sides by guardrails. It is commonly observed that fragile barricade tapes are used as a substitute of a strong and dependable fencing. This practice is prohibited. The barricade tapes can be used as markers/route guide only;
- m. Elevated workplaces shall be provided with safe means of access and egress such as stairs, ramps or ladders according to suitability;
- n. Persons employed at elevated workplaces or other situations at more than 2m from which they may fall, shall be protected by means of adequate safety nets, or platforms, or be secured by

safety belts with the lanyard properly anchored above the head level of the user. All possible effort shall be made to have strong and dependable mechanical arrangement.

1.13. Protection against fall of objects and materials:

- a. Materials and objects such as scaffolding materials, waste materials or tools shall not be thrown up or down from heights, as they are liable to cause injury;
- b. If materials and other objects cannot be safely lowered from heights, adequate precautions such as the provision of fencing, lookout men or barriers shall be provided to protect any person from injury.

1.14. Protection against entry of unauthorized persons:

- a. Construction zones in the site and built up areas alongside main traffic routes shall be barricaded;
- b. Unauthorized persons shall not be allowed access to construction sites and visitors shall be provided with the required protective equipment and it be ensured that they use them effectively.

1.15. Head protection and other protection apparel:

Every building worker who is required to –

- a. Pass through or working within the areas where there is hazard of his being struck by falling objects or materials, shall be provided with safety helmets of the type approved and tested in accordance with the national standards;
- b. Work in water or in wet concrete or in other similar work, shall be provided with suitable waterproof;
- c. Work in rain or in similar wet condition, shall be provided with waterproof coat with hat;
- d. Workers using or handling of alkalis, acid or other similar corrosive substances shall be provided with appropriate protective equipment in accordance with the approved standards;
- e. Every building worker engaged in handling sharp objects or materials at a building or other construction work, which may cause hand injury, shall be provided with suitable hand gloves in accordance with the approved standards.

1.16. Stability of structures:

- a. No wall, chimney or other structure or part of a structure shall be left unsupported in such condition that it may fall, collapse or weaken due to wind pressure, vibration or due to any other reason. Entry of persons into such locations where tall structures are being built shall be regulated without a let up.

1.17. Safety of Structures and equipment and other safety concerns

- a. Safety of structures like scaffoldings, platforms, gangways/walkways, towers, stairs, ladders, ramps, safety in excavation, formwork, falsework, demolition work, storage, handling and use of explosives, inflammable substances and hazardous materials, gas cutting and welding, use of electricity etc.; and equipment viz. construction machinery, crushers and batching plant, boiler and other pressure vessels, transport and material handling equipment, lifting appliances, vehicles etc., shall be operated and maintained as per approved norms and –
 - i. They shall be made of sound material and of good construction, free from patent defects, provided with adequate safe guards, properly maintained, periodically inspected and strong enough to withstand safely the loads and stresses to which they may be subjected;
 - ii. They shall carry enough factor of safety bearing in mind that the possibility of their abuse, which otherwise shall be prevented by constant and adequate supervision, cannot be ruled out altogether;
 - iii. It is incumbent on the contractor to ensure that only competent and authorized persons operate the equipment or attend to electrical and mechanical systems and repair of faults or breakdowns etc.
- b. Working in the confined space may involve certain serious hazards. Strict adherence to the conditions of Permit-to-work issued for the purpose is required;
- c. Control of energy sources shall be ensured through Log-out/Tag-out practices.

1.18. Slipping, tripping, cutting, drowning and falling hazards:

- a. The contractor shall keep all passageways, platforms and other places free from accumulations of dust, debris or similar material and from other obstructions that may cause tripping;
- b. Any sharp projections or protruding nails or similar projections which may cause any cutting hazard to a building workers shall be removed or otherwise made safe by taking suitable measures;
- c. No contractor shall allow any building worker at construction work to use the passageway, or a scaffold, platform or any other elevated working surface which is in slippery and dangerous condition and shall ensure that water, grease, oil or other similar substances which may cause the surface slippery, be removed or sanded/saw-dusted or covered with suitable material to make it safe from slipping hazard;
- d. Wherever building workers are exposed to the hazarded of falling into water, they shall be provided with rescuing arrangement from such hazard and if it is considered necessary, well equipped boat or launch manned with trained personnel shall be provided by the contractor at the site of such work;
- e. Every open side or opening into or through which a building worker, vehicle or lifting appliance or other equipments may fall at a building or other construction work shall be covered or guarded suitably to prevent such fall except where free access is necessary by reasons of their nature of the work;
- f. Wherever building workers are exposed to the hazards of falling from height while employed on such work they shall be provided by the employer with adequate equipment or means for

saving them from such hazards, Such equipments or means shall be in accordance with the standards as laid down;

- g. Whenever there is a possibility of falling of any martial, equipment or building worker at a construction site relating to a building or other construction work, adequate and suitable safety net shall be provided in accordance with the above stipulation;

2.0 SAFETY IN MATERIAL HANDLING AND WASTE DISPOSAL

2.1. GENERAL PROVISIONS:

- a. All building materials stored in tiers shall be stacked, racked, blocked, interlocked or otherwise secured safely to prevent sliding, falling or collapse and in an orderly manner to avoid obstruction of any passageway at the place of work. Piles of materials shall be stored or stacked in such a manner as to ensure their stability;
- b. Maximum safe load limits of floors within buildings and structures in kg/cm² shall be conspicuously posted in all storage areas, except for floor or slab on gradient. Maximum safe load shall not be exceeded. Material or equipment shall not be stored upon any floor or platform in such quantity as to exceed its safe carrying capacity;
- c. Ailes and passageways shall be kept clear to provide for the free and safe movement of material handling equipment or persons. Such areas shall be kept in good repair;
- d. When a difference in road or working levels exist, means such as ramps, blocking or grading shall be used to ensure the safe movement of vehicles between two levels;
- e. Material stored inside buildings under construction shall not be placed within 2 m of any hoist way or inside floor openings nor within 3.2 m of exterior wall which does not extend above the top of material stored;
- f. Persons employed required to work on stored material in silos, hoppers and similar storage areas shall be equipped with lifelines and safety belts;
- g. Non-compatible materials shall be segregated in storage;
- h. Bagged materials shall be stacked by stepping back the layers and cross-keeping the bags at least every 10 bags high;
- i. Materials shall not be stored on scaffolds or runways in excess of supplies needed for immediate operations;
- j. Bricks stacks shall not be more than 2.2 m in height. When a loose brick stack reaches a height of 1.3 m it shall be tapered back 5 cm in every foot of height above the 1.25 m level;
- k. When masonry blocks are stacked higher than 2 m, the stack shall be tapered back on half block per tier above the 2 m level;
- l. Material or equipment shall not be stored or placed so close to any edge of a floor or platform as to endanger the safety of persons below or working in the vicinity. Where stacking, unshackling, stowing or unstacking of construction material or article, or handling in connection therewith cannot be safely carried out unaided, reasonable measures to guard against accident or dangerous occurrences shall be taken by shoring or otherwise to prevent any danger likely to be caused by such handling;
- m. Stacking of material or article shall be made on firm foundation not liable to settle and such material or article shall not overload the floor on which such stacking is made;

- n. The material or articles shall not be stacked against partition or walls of a warehouse or stores unless it is known that such partition or the wall is of sufficient strength to withstand the pressure of such materials or articles;
- o. The materials or articles shall not be stacked to such a height and in such a manner as would render the pile of such stack unstable and cause hazards to the building workers or the public in general;
- p. Where the building workers are on stack exceeding one point five meters in height, safe means of access to the stack shall be provided;
- q. All stacking or unstacking operations shall be performed under the supervision of a responsible person for such stacking or unstacking;
- r. The stacking of construction materials or articles shall not be made near the site of excavation, shaft, pit or any other such opening;
- s. Stacks that may lean heavily or become unstable or collapse are barricaded shall be avoided;
- t. Structural steel, poles, pipe, bar stock and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent sliding, spreading or tilting.

2.2. LUMBER:

- a. Used lumber shall have all nails withdrawn before stacking;
- b. Lumber shall be stacked on level and solidly supported sills;
- c. Lumber piles shall not exceed 6 m in height provided that lumber is handled manually, shall not be stacked more than 5 m height;
- d. Lumber shall be so stacked as to be stable and self-supporting.

2.3. STACKING OF CEMENT AND BAGS CONTAINING OTHER MATERIALS:

- a. The cement or other material in bags shall be stacked in a header and stature-wise in rows alternately in not more than 10 numbers and there will be circulation of space of at least 600 mm in between two such rows;
- b. While removing bags from the stack pile the stability of such stack pile shall be ensured;
- c. Bags containing cement or lime shall be stored on a firm ground;
- d. The materials like bricks, tiles or blocks shall also be stored on a firm ground;
- e. Reinforcing steel shall be stored according to its shape, size and length and stack of reinforcing steel kept as low as possible;
- f. No pipe shall be stored on rack or in stack where such pipe is likely to fall by rolling;
- g. The angle of repose shall be maintained where loose materials are stacked;
- h. When dust laden material is to be stored or handled, measures shall be taken to suppress the dust produced by such storing or handling and suitable personal protective equipment supplied to and used by the building workers working for such storing or handling.

2.4. DISPOSAL OF DEBRIS AND WASTE MATERIAL:

- a. It shall be ensured that debris is
 - i. Handled and disposed of by a method, which does not cause danger to the safety of a person and not allowed to accumulate so as to constitute a hazard;
 - ii. Kept sufficiently moist to bring down the dust under control;
 - iii. Not thrown inside or outside from any height of such building or other construction work;
- b. Brought down by suitable means/chutes provided for the purpose and on completion of work, leftover building material, article or other substance or debris shall be disposed off as soon as possible to avoid any hazard to any traffic or person;
- c. Whenever materials are dropped more than 6 m to any point lying outside the exterior walls of the building an enclosed chute of wood, or equivalent material shall be used;
- d. When debris is dropped through holes in the floor without the use of chutes, the area where the material is dropped shall be completely enclosed with barricades not less than 1.1 m high and not less than 1.9 m back from the edge of the opening above. Signs warning of the hazard of falling material shall be posted at each level;
- e. All scrap lumber, waste material and rubbish shall be removed from the immediate work area as the work progresses;
- f. Disposal of waste material or debris as per the guideline issued by CPCB in compliance of Rule 10 sub-rule 1(a) of C & D Waste Management Rules, 2016).
- g. All bio-degradable material shall be disposed off in the pit for making compost. Pellets can also be made from bio-degradable material
- h. All solvent wastes, oil rags and flammable liquids shall be kept in fire resistant covered containers until removed from the work site.

2.5. HANDLING GAS CYLINDERS:

- a. Gas cylinders shall not be lifted on bare slings. For lifting the cylinders, cage of suitable size shall be used and all cylinders shall be horizontally positioned in it. Such cage shall have fencing in such a way that there is no possibility of fall of cylinders from this cage.

2.6. RIGGING EQUIPMENT FOR MATERIAL HANDLING:

- a. Rigging equipment for material handling shall be inspected prior to use in each shift as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed from service;
- b. Rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in the Indian standards;
- c. Rigging equipment, when not in use, shall be removed from the immediate work area so as not to present a hazard to persons engaged in the area;

- d. Special custom designed grabs, hooks, clamps, or other lifting accessories, for such units as modular panels, prefabricated structures and similar materials, shall be marked to indicate the safe working loads shall be proof tested prior to use 125% of their rated load;
- e. Welded alloy steel chain slings shall have permanently affixed-durable identification standing size, grade, rated capacity and manufacturer.

2.7. FENCING OF MOTORS ETC

- a. All motors, cogwheels, chains and friction gearings, flywheels, shafting and the other dangerous and moving parts of machinery (whether or not driven by mechanical power) and steam pipes shall be securely fenced and the fencing of dangerous parts of machinery not removed while such machinery is in motion or in use;
- b. No part of any machinery which is in motion and which is not securely fenced, shall be examined, lubricated, adjusted or repaired except by a person skilled and trained for such examination, lubrication, adjustment or repairs and machine parts cleaned only when such machine is stopped;
- c. When a machine is stopped for servicing or repairs, adequate measures shall be taken to ensure that such machine does not restart inadvertently and not only tag-out sign is required; it is also essential that an active system of isolating the power be applied.

2.8. PROTECTION AGAINST LIGHTNING

- a. Where necessary, installations shall be protected against lightning, provided further that;
- b. No bare conductors or bare current-carrying parts of equipment be permitted to be installed unless adequate precautions are taken to prevent direct or indirect contact;
- c. Only flame-proof equipment and conductors shall be installed at places where explosives or inflammable substances are stored, handled or used or where explosive atmosphere exists;
- d. Persons competent and authorized only shall attend to electrical breakdowns and other operational faults and give or restore power to an equipment and such persons shall be easily identifiable by their dress or special helmet worn;
- e. It will constitute a standard practice to switch off portable tools while shifting from one place to another or while leaving them behind unattended;
- f. The contractor shall ensure that a system is in place to always keep tools well maintained.

2.9. VEHICULAR TRAFFIC

- a. Whenever any building or other construction work is being carried on, or is located in close proximity to a road or any other place where any vehicular traffic may cause danger to building workers, it shall be ensured that such building or other construction work is barricaded and suitable warning signs and lights displayed or erected to prevent such danger and if necessary, a request in writing made to the concerned authorities to control such traffic;

- b. All vehicles used at construction site shall comply with the requirements of the Motor Vehicles Act, 1988 (59 of 1988) and the Rules made hereunder;
- c. The driver of a vehicle of any class or description operating at a construction site shall hold a valid driving license under the Motor Vehicles Act. 1988 (59 of 1988).

2.10. USE OF SAFETY BELT OR OTHER FALL ARREST SYSTEMS:

Wherever any work at a height of 3 m or more is carried out, use of a suitable fall arrest system is mandatory if the workplace has already not been provided with an otherwise reliable means of protection for preventing the fall of persons from that height, provided further that:

- a. Safety belt, lanyard, life lines and devices for the attachment of such life lines shall conform to the approved standards;
- b. Every building worker shall be supplied with safety belt and safety life lines for his protection and such building worker shall use such belts and life lines during the performance of his work;
- c. All building workers using safety belt and safety life lines shall have the knowledge of safe use and maintenance of such belts and life lines and shall be supplied with necessary instructions for its use;
- d. The responsible person for supervising the use of safety belts and safety lifelines shall inspect and ensure that such safety belts and lifelines are fit for use before taking them into use.

2.11. SAFETY NET AND ITS USE

- a. Every safety net shall be of adequate strength, made of sound material and suitable for use and conform to the approved standards;
- b. The responsible person for maintenance of safety nets and their use shall ensure safe fixing of such safety nets and provide such safety nets with suitable and sufficient anchorage so that the purposes for which such safety net is intended for use is served;
- c. Use of multi-layer safety net to be ensured to avoid fall of material/objects.

2.12. STORAGE OF SAFETY BELTS AND NETS, ETC:

- a. Proper arrangement shall be made for the safe storage of safety belts, safety lifelines and safety nets when they are not in use and are protected against mechanical damage, damages from chemicals and damages from biological agents.

2.13. SAFETY HELMETS AND SAFETY FOOTWEAR

- a. The Engineer in-charge may declare whole or part of a site as the hardhat area and in such an eventuality it shall be the responsibility of the contractor to provide safety helmet of the approved quality to all personnel engaged in construction and erection work, including the visitors to the site;
- b. Accordingly, wherever safety footwear is required for the safety of the personnel, the contractor shall provide the same of the approved type free of charge.

3.0 WELDING AND GAS CUTTING OPERATIONS

3.1 GAS WELDING:

3.1.1 GENERAL PROVISIONS:

- a. All welders shall be provided with fire resistant protective clothing and equipment, such as fire resistant gauntlets and aprons, helmets and goggles with suitable filter lenses and its usage shall be ensured;
- b. The welders shall not be allowed to wear clothing that is not free from grease, oil and other flammable material;
- c. Adequate precautions shall be taken to protect persons working or passing near welding operations from dangerous sparks and radiation;
- d. When welding or cutting is being done on materials containing toxic or harmful substances or liable to produce toxic or harmful fumes, adequate precautions shall be taken to protect workers from the fumes, either by
 - i) Exhaust ventilation, or
 - ii) Respiratory protective equipment;
 - iii) Arrangement shall be made so that welding sparks do not fall down on the persons working below or material, which are combustible in nature and may be damaged with such sparks.
- e. The oxygen pressure for welding shall always be high enough to prevent acetylene flowing back into the oxygen cylinder;
- f. Acetylene shall not be used for welding at a pressure exceeding 1 atmosphere gauge;
- g. Adequate precautions shall be taken to prevent:
 - i) Fire being started by sparks,
 - ii) Slag or hot metal; and
 - iii) Damage to fibre ropes from heat, sparks, slag or hot metal;
- h. Precautions shall be taken to prevent flammable vapours and substances from entering the working area;

3.2. WELDING AT PLACES WITH FIRE RISKS:

- a. Unless adequate precautions are taken, no welding or cutting operations shall be allowed near the place where combustible materials are stored, or near materials or plant where explosive or flammable dusts, gases or vapours are likely to be present or given off. If hot work permit system exists at the site, the same shall be followed;
- b. Combustible materials and structures that cannot be removed from the vicinity of welding operations shall be shielded by asbestos or protected by other suitable means.

3.3. WELDING IN CONFINED SPACE:

When welding or cutting operations are being carried out in a confined space;

- a. Adequate ventilation, by means of exhaust fans or forced draught as the condition may require, shall be constantly provided; otherwise enough quantity of air shall be blown in by means of compressors to dilute the pollutants;

- b. No blow pipe shall be left unattended inside a tank or vessel or other confined space during meal break or other interruption of the work;
- c. The worker shall take all necessary precautions to prevent unburned combustible gas or oxygen from escaping inside a tank or vessel or other confined space; and
- d. When necessary to prevent danger, an attendant shall watch the welders from outside.

3.4. WELDING ON CONTAINERS FOR EXPLOSIVE OR FLAMMABLE SUBSTANCES:

Welding or cutting operations on containers in which they are explosives or flammable substances shall not be allowed;

- i) Welding or cutting operations on any container that has held explosive or where flammable gases may have been generated, shall only be undertaken,
- ii) After the container has been thoroughly cleansed by steam or other effective means; and
- iii) Found by air tests to be completely free from combustible gases and vapours; or
- iv) After the combustible gas in the container has been completely replaced by an inert gas or by water;
- v) If an inert gas is used as laid down in clause 4.2.3, after the vessel has been filled with gas, the gas shall continue to flow slowly into it thorough out the welding or cutting operations;
- vi) Before starting any welding operations on, or otherwise applying heat to, closed or jacketed containers or other hollow parts, such containers or parts shall be adequately vented in suitable manner.

3.5. GAS CYLINDERS

- a. Gas cylinders shall be inspected, stored, handled and transported in conformity with the requirements of Gas Cylinders Rules, 1981;
- b. When in use, cylinders shall be held in upright positions by straps, collars or chains;
- c. Devices referred to in clause 6.2 shall be such that the cylinders can be rapidly removed in an emergency;
- d. Welders shall not temper with or attempt to repair safety devices and valves on gas cylinders;
- e. When acetylene cylinders are coupled, flash back arrestor shall be inserted between the cylinder and the coupler block, or between the coupler block and the regulator;
- f. Only acetylene cylinders or approximately equal pressure shall be coupled;
- g. No gas shall be taken from a cylinder unless a pressure reducing regulator has been attached to the valve;
- h. Only the right pressure reducing regulator shall be used for the gas in the cylinder;
- i. Cylinder valves shall be kept free from gases, grease, oil, dusts and dirt;
- j. Leaky cylinders charged with acetylene or liquefied fuel gas shall be taken into the open air at a safe distance from any open flame or sparks.

3.6 HOSE

- a. Only hose especially designed for welding and cutting operations shall be used to connect an oxy-acetylene torch to gas outlet;
- b. Hose lines for oxygen and for oxy-acetylene shall be of different colours and preferably of different size;
- c. Hose connections shall be sufficiently light to withstand without leakage a pressure twice the maximum delivery pressure of the pressure regulators in the system;

- d. Care shall be taken that hose does not become kinked or tangled, stepped on or run-over or otherwise damaged;
- e. Any length of hose in which a flashback has burned, shall be discarded;
- f. No hose with more than one gas passage shall be used;
- g. Only soapy water shall be used for testing hose for leaks.

3.7. TROCHES

- a. When torches are being changed, the gases shall be shut off at the pressure reducing regulators and not by crimping hose;
- b. Torches shall be lit with friction lighters or other safe source but not with matches.
- c. Electric welding equipment:
- d. Welding machines shall be controlled by a switch mounted on or near the machine framework that, when opened, immediately cuts off the power from all conductors supplying the machine;
- e. Welding circuit shall be so designed as to prevent the transmission of high potential from the source of supply to the welding electrodes;
- f. The maximum open circuit voltage shall be in accordance with Indian Standards;
- g. Electrode conductors or cables shall not be excessive in length and shall not be longer than necessary to perform the work;
- h. Return conductors shall be taken directly to work and securely connected mechanically and electrically to it or to the work bench, floor etc. and to an adjacent metallic object;
- i. Cable shall be supported so as not to create dangerous obstruction;
- j. Motors, generators, rectifiers and transformers in arc welding or cutting machines, and all current carrying parts, shall be protected against accidental contact with uninsulated live parts;
- k. Ventilating slots in transformer enclosures shall be so designed that no live part is accessible through any slot;
- l. Frames of arc welding machines shall be effectively earthed;
- m. In hand-operated arc welding machines, cables and cable connectors used in arc welding circuits shall be effectively insulated on the supply side;
- n. The outer surface electrode holders of hand-operated arc welding machines, including the jaw so far as practicable, shall be effectively insulated;
- o. Electrode holders of hand-operated arc-welding machines shall, if practicable, be provided with discs or shields to protect the operator's hands from the heat of the arcs;
- p. Only heavy-duty cable with unbroken insulation shall be used;
- q. Circuit connections shall be waterproof;
- r. When lengths of cable have to be joined, only insulated connectors shall be used on the earth line and the electrode holder line;
- s. Connections to welding terminals shall be made at distribution boxes, socket outlets, etc. by bolted joints;
- t. Welding terminals shall be adequately protected against accidental contact by enclosures, covers or other effective means;
- u. Electrode holder shall
 - i. Have adequate current capacity;
 - ii. Be adequately insulated to prevent shock, short-circuiting or flashovers.

3.8. OPERATIONS

- a. Arc welding and cutting operations that are carried on at places where persons other than the welders are working or passing shall be enclosed by means of suitable stationary or mobile screens;
- b. Walls and screens of both permanent and temporary protective enclosures shall be provided to absorb harmful rays from the welding equipment and prevent reflection, and if necessary, be painted or otherwise treated for the purpose;
- c. When arc welding is done in damp confined spaces;
 - i) Electrode holders shall be completely insulated; and
 - ii) The welding machines shall be outside the confined space;
- d. Welders shall take adequate precautions
 - i) To prevent any part of their body from completing an electric circuit
 - ii) To prevent contact between any part of the body and the exposed part of the electrode, or electrode when in contact with metal; and
 - iii) To prevent wet or damaged clothing, gloves and boots from touching any live part;
- e. Welding circuits shall be switched off when not in use;
- f. Electrodes shall only be inserted in the holder with insulating means such as insulating gloves;
- g. Electrode and return leads shall be adequately protected against damage;
- h. Live parts of electrode holders shall be inaccessible when they are not in use;
- i. Electric arc-welding equipment shall not be left unattended with current switched on.

4.0 SAFETY IN THE USE OF ELECTRICITY

4.1. GENERAL PROVISIONS

- a. Before commencement of any building or other construction work, adequate measures shall be taken to prevent any worker from coming into physical contact with any electrical equipment or apparatus, machines or live electrical circuit which may cause electrical hazard during the course of his employment and suitable warning signs shall be displayed and maintained at conspicuous places in Hindi and in local language understood by the majority of the building workers;
- b. In workplaces where the exact location of underground electric power line is not known, the building workers using jack hammers, crow bars or other hand tools which may come in contact with a live electrical line shall be provided with approved insulated protective gloves and footwear;
- c. As far as practicable, no wiring or cable, which may come in contact with water or which may be mechanically damaged or which may result in electric shock shall be left on ground or;
- d. All electrical appliances and current carrying equipment used shall be made of sound material and adequately earthed;
- e. All temporary electrical installations shall be provided with earth leakage circuit breakers;
- f. It is required that all portable power-driven hand tools are provided with double insulation to secure a high degree of protection from electrical hazards;
- g. Electrical installations shall comply with the requirements of any law for the time being in force, especially the Indian Electricity Act/Rules in particular with specific reference to the following:
 - i) All parts of installations shall be of standard construction not lower, from the safety point of view, than the national standards, as applicable. All parts of electrical installations shall be so constructed, installed and maintained so as to prevent electrical fires, explosion and shock;
 - ii) Earthing of metal work of electrical equipment, other than the parts which carry current, shall be provided and will conform to Electricity Act and IS: 3042 – 1966 (code of practice for earthing);
- h. All parts of electrical installation shall be adequate size and characteristics for the work they may be called upon to do and in particular they shall:
 - i) Be of adequate mechanical strength to withstand working conditions in construction operations; and
 - ii) Be not liable to damage by water, dust or electrical, thermal or chemical action to which they are subjected to in construction operations;
- i. All parts of electrical installations shall be so constructed, installed and maintained as to prevent the danger of electric shock; fire and external explosion;
- j. It shall be made impossible for circuit breakers to be opened or closed inadvertently, by gravity or by mechanical impact;

- k. Before operation of OCBs, oil level must be checked and the event of short, extra quantity must be filled;
- l. Use of rubber gloves and rubber gum boots of tested quality where electric shock is likely to occur shall be provided, but these shall not be considered as providing adequate protection against the risk of electric shock in lieu of inbuilt safety arrangement in the system;
- m. First-aid boxes, instruction for restoration of persons affected by electric shock shall be made;
- n. Arrangement shall be made for sufficient number of CO₂/chemical powder type fire extinguishers/sand buckets etc.;
- o. No electrical circuits shall ever be overloaded to the dangerous extent or beyond the rated capacity;
- p. In confined areas, only 24 volt supply shall be used for every equipment, including hand-held portable tools and hand lamps;
- q. All electrical appliances and outlets shall be clearly marked to indicate their purpose and voltage.

4.2. FUSES

- a. Fuses shall bear markings indicating their rated current, whether they are of the fast or slow-breaking type and, as far as practicable, and their rated breaking capacity. Fuses as per need and of correct rating shall be used in the circuit;
- b. Effective measures shall be taken to ensure that persons removing or inserting fuses will not be endangered, in particular by any adjacent live parts;
- c. In case of blow of fuses only after finding out and correcting of the fault, new fuses shall be provided in the circuit.

4.3. SWITCHES

- a. All switches shall be of enclosed type and so installed and earthed as to prevent danger in their operation;
- b. Use of switches, which may connect or disconnect circuit through gravity, shall not be used.

4.4. MOTORS

- a. All motors shall be equipped with a switch;
- b. When a motor can be cut off from more than one place, where practicable, a stopping device shall be installed in the immediate vicinity of the motor;
- c. Motors shall be so installed as to ensure that they can be adequately cooled;
- d. Motors shall be effectively protected against over current;
- e. Whenever the motors installed are in the open area where there is the possibility of fall of liquid corrosives or otherwise, it shall be suitably protected with covering;
- f. Earthing shall be connected to all motors, generators etc. as prescribed in the Indian Electricity Rules, amended from time to time.

4.5. CONNECTIONS

- a. At points where conductors are joined, branched or led into apparatus, they shall be:
 - i. Mechanically protected, and
 - ii. Properly maintained;

- b. Conductors shall be joined, branched or led into an apparatus through junction boxes, bushings, glands or equivalent connecting devices;
- c. Junction boxes or plug-out-socket couplings shall be used for joining cables wherever practicable;
- d. When parts of conductors are joined together, or conductors are joined to one another or to an apparatus, the attachment shall be made by screwing, clamping, soldering, riveting, brazing, crimping, or equivalent means. Loose connections shall not be provided in any case;
- e. Cable joints, junction boxes and connectors shall be protected as far as practicable, against traffic, fall of ground, water and other sources of damage;
- f. Whenever armoured cables are joined, the junction boxes shall be bridged by a suitably conductive bond between the armoring of the cables.

4.6. TRANSPORTABLE AND PORTABLE ELECTRICAL EQUIPMENT:

- a. The supply of electricity to portable apparatus shall not exceed 250v;
- b. Hand-held and portable machines shall be equipped with a built-in switch to switch off power in case of emergency;
- c. Hand-held electrically operated tools shall be provided with built-in switch to disconnect the circuit when the tool is not being used;
- d. Portable electrical tools, unless flameproof, shall not be used in flammable or explosive atmosphere;
- e. Only three-core cable shall be used for single-phase operated tools with the third core connected to earth

4.7. HAND LAMPS

- a. Hand lamps shall be equipped with strong cover of glass or other transparent material;
- b. Portable lamp holders shall have:
 - i) All current –carrying parts enclosed;
 - ii) Insulated handle; and
 - iii) They shall operate at 24 v;

4.8. INSPECTION, MAINTENANCE

- a. All electrical equipment shall be inspected before it is taken into use to ensure that it is suitable for its purpose of use;
- b. At the beginning of every shift every person using electrical equipment shall make a careful external examination of the equipment and conductors for which he is responsible, especially flexible cables;

- c. Periodic inspections, testing, maintenance of all electrical equipment is to be made and record of test of transformer oil and pit earthing shall be maintained;
- d. Electrical conductors and equipment shall be repaired by the electrician only as far as practicable, no work shall be done live conductors or equipment;
- e. Before any work is begun on conductors or equipment that does not have to remain live;
 - i) The current shall be switched off;
 - ii) Adequate precautions shall be taken to prevent the current from being switched on again;
 - iii) The conductors or the equipment shall be tested to ascertain that they are dead;
 - iv) The conductor and equipment shall be earthed and short-circuited; and
 - v) Neighbouring live parts shall be adequately protected against accidental contact;
- f. After work on conductors and equipment, the current shall only be switched on again on the orders of a competent person;
- g. Electricians shall be provided with adequate tools, and person protective equipment, such as rubber gloves, mats etc.;
- h. All conductors and equipment shall be considered to live unless there is certain proof to the contrary.

4.9. WORK IN THE VICINITY OF ELECTRICAL INSTALLATION

- a. When work is to be done in the neighborhood of electrical conductors or installations, the contractor shall ascertain the voltage carried and the works shall not be allowed to reach to unsafe distance from them;
- b. When any excavation is to be made or any bore-holed sunk, the contractor shall ascertain whether there are any underground conductors, in or in dangerous proximity to, the zone of operations;
- c. No work shall be done in dangerous proximity to a conductor or an installation until it has been made dead;
- d. Before work begins, work permit shall be obtained from the Engineer in-charge if live electricity lines/circuit are passing in close vicinity;
- e. Before the current is restored, the contractor shall ensure that no work remain on the work site;
- f. If conductor or an installation in the neighbourhood of which work is to be done can not be made dead, special precautions shall be taken and special instructions given to the workers so as to prevent danger by adequately enclosing or fencing;
- g. If mobile equipment has to be employed in the neighbourhood of conductors or installations that cannot be made dead, its movement shall be so controlled as to keep it at a safe distance from them.

5.0 SAFETY IN THE USE OF HAND TOOLS AND POWER-OPERATED TOOLS

5.1 GENERAL PROVISIONS

- a. All hands and power tools and similar equipment, shall be maintained in safe condition.
- b. When power operated tools are designed to accommodate guards, they shall be equipped with such guards, when in use;
- c. Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains and other reciprocating, rotating or moving parts of the equipment shall be similarly guarded;
- d. Personnel using hand and power tools and exposed to the hazard of falling, flying, abrasive, and splashing objects, or exposed to harmful dusts, fumes, mists, vapours, or gases shall be provided with the particular personal protective equipment necessary to protect them from the hazards;
- e. All hand-held powered platen sanders, grinders, grinders with wheels of 5 cm or less, routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks of 0.5 cm wide or less shall be equipped with only a positive **on-off control**.
- f. All hand-held powered drills, tappers, fastener drivers, horizontal, vertical or angle grinders with wheels greater than 5 cm in diameter, disc sanders, belt sanders, reciprocating saws, saber saws and other operating powered tools shall be equipped with a momentary contact on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

5.2. HAND TOOLS

- a. The contractor shall not issue or permit the use of unsafe hand tools;
- b. Wrenches including adjustable pipe end and socket wrenches shall not be used when saws are sprung to the point that slippage occurs;
- c. Impact tools such as drift pins, wedges and chisels shall be kept free of mushroomed heads;
- d. The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight on the tools.

5.3. POWER OPERATED TOOLS

- a. Electric power operated tools shall be either of the approved double-insulated type or shall be grounded;
- b. The use of electric cords for hoisting or lowering loads shall not be permitted;
- c. Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected;
- d. Safety clips or retainers shall be securely installed or maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled;
- e. All pneumatically riveting machine staplers and other similar equipment provided with automatic fastener feed, which operate at more than 7 kg/cm² pressure at the tool a safety device on the

muzzle to prevent the tool from ejecting the fasteners unless the muzzle is in contact with the work surface;

- f. Compressed air shall not be used for cleaning purposes except when the pressure is reduced to less than 2 kg/cm² and that too with effective chip guarding. The 2 kg/cm² pressure requirement does not apply to concrete form, mill scale and similar cleaning purposes;
- g. The manufacturer's safe operating for hoses, pipes, valves, filters and other fittings shall not be exceeded;
- h. Only personnel who has been trained in the operation of the particular tool shall be allowed to operate power-actuated tools;
- i. The tool shall be tested each day before loading to see that the safety devices are in proper working condition. The method of testing shall be accordance with the manufacturer's recommended procedure;
- j. Any tool found not in proper working order, or that which develops a defect during use, shall be immediately removed from service and not used until properly repaired;
- k. Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any other person. Hands shall be kept clear of the open barrel end;
- l. Loaded tools shall not be left unattended;
- m. Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tiles, surface hardened steel, glass block, live rock, face brick or hollow tiles;
- n. Driving into materials that can be easily penetrated shall be avoided unless backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side;
- o. No fastener shall be driven into a palled area caused by an unsatisfactory fastening;
- p. Only non-sparking tools shall be used in an explosive or flammable atmosphere;
- q. All tools shall be used with the correct shield, guard or attachment as recommended by the manufacturer.

5.4. ABRASIVE WHEELS AND TOOLS

- a. All grinding machines shall be supplied with sufficient power to maintain the spindle speed at safe levels under all conditions of normal operation;
- b. Grinding machines shall be equipped with suitable safety guards;
- c. The maximum angular exposure of the grinding wheel periphery and sides shall not be more than 90⁰, except that when the work requires contact with the wheel below the horizontal plane of the spindle, the angular exposure shall not exceed 120⁰. In either case, the exposure shall begin not more than 65⁰ above the horizontal plane of the spindle. Safety guards shall be strong enough to withstand the bursting of the wheel;
- d. Floor and bench-mounted grinders shall be work-rests, which shall be rigidly supported and readily adjustable. Such work-rests shall be kept at a distance not to exceed 5 mm from the surface of the wheel;

- e. Cup type wheels used for external grinding shall be protected by either revolving cup guard or a band type guard;
- f. When safety guards are required, they shall be mounted as to maintain proper alignment with the wheel and the guard and the guard and its fastening shall be adequate strength to retain the fragments of the wheel in case of accidental breakage. The maximum angular exposure of the grinding wheel periphery and sides shall not exceed 180°;
- g. Portable abrasive wheel used for internal grinding shall be provided with suitable safety flanges;
- h. When safety flanges are required, they shall be used only with wheels designed to fit the flanges. Only safety flanges, of a type and design and properly assembled so as to ensure that the pieces of the wheel will be retained in case of accidental breakage, shall be used;
- i. All abrasive wheels shall be closely inspected and ring tested before mounting to ensure that they are free from cracks or defects;
- j. Grinding wheels shall fit freely on the spindle and shall not be forced on. The spindle nut shall be tightened only enough to hold the wheel in place;
- k. All employees using abrasive wheels shall be protected by suitable eye protection equipment.

5.5. WOODWORKING TOOLS

- a. All fixed power driven woodworking tools shall be provided with a disconnect switch that can either be locked or tagged in the **off-position**;
- b. The operating speed shall be attached or otherwise permanently marked on all circular saws over 0.5 m in diameter or operating at over 3000 peripheral rpm. Any saw so marked shall not be operated at a speed other than that marked on the blade. When a marked saw is retensioned for a different speed, the marking shall be corrected to show the new speed;
- c. Automatic feeding devices shall be installed on machines wherever the nature of the work will permit. Feeder attachments shall have the feed rolls or other moving parts covered or guarded so as to protect the operator from hazardous points;
- d. All portable power driven circular saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to the covering position.

6.0 SAFETY IN THE USE OF LADDERS AND STAIRS

6.1. GENERAL ASPECTS OF SAFETY RELATED TO USE OF LADDERS

- a. Every ladder or step-ladder used in building or other construction work shall be of good construction, made of sound material and of adequate strength for the purpose for which such ladder or step-ladder is used;
- b. When a ladder is used as a means of communication, such ladder shall be lashed to a fixed structure so that while working on such ladder it does not slip;
- c. A ladder or step ladder shall not stand on loose bricks or other loose packing and have a level and firm footing;
- d. No ladder shall be used which has a missing or defective rungs or rungs, which depend for support solely on nails, spikes or other similar fixing.

6.2. MATERIALS FOR LADDERS

- a. Shall be constructed with upright of adequate strength and are made of straight-grained wood, free from defects and having the grain of such wood running length wise;
- b. Shall have rungs made of straight-grained wood free for defects and mortised or securely notched into the upright, reinforcing metal ties, if wedges shall not secure the tenors of such ladders;
- c. Where it is required, in case of use of fixed ladders, sufficient foot-hold and hand-hold shall be provided for use by the building worker;
- d. Every ladder shall be -
 - i. Secured so as to prevent undue swaying;
 - ii. Equally and properly supported on each of its upright;
 - iii. So used as not to cause undue sagging; and
 - iv. Placed as nearly as possible at an inclination of four in one;
- e. The use of all ladders and stepladders shall conform to the approved standards;
- f. Wooden ladders shall be constructed with uprights of adequate strength as well as rungs made of wood free from visible defects and having the grains of the wood in the ladders running lengthwise and rungs mortised or rebuted into the uprights;
- g. Uprights and rungs of metal ladders shall have a cross-section adequate to prevent dangerous deflection, shall be equal and not less than 25 cm or more than 35 cm;
- h. Rungs of metal ladders shall be kept clean so as to prevent them from becoming slippery;
- i. Portable ladders shall not exceed 9 m in length;
- j. Every ladder or run of ladders rising to a height exceeding 9 m shall be provided with an intermediate landing, providing further that the intervals between landings shall not exceed 9 m. The landings shall be of suitable size and protected by railings;
- k. Defective ladders that cannot be satisfactorily repaired shall be tagged Not Fit For Use and destroyed;
- l. Wooden ladders shall not be painted, but oiled or covered with clean varnish or other transparent preservatives;
- m. Metal ladders shall be protected against corrosion by being coated with rust-proof paint or by other means unless they are made of non-corrosive metals;

- n. Every ladder shall rise at least 1 m above the highest point to be reached and have one of the uprights continued to that height to serve as a hand-rail at the top;
- o. Ladders shall not stand on loose bricks or other loose packing but have a level and firm footing so that they are equally supported on each upright;
- p. Every ladder shall be securely fixed so that it cannot move from its top and bottom points of rest and if it cannot be secured at the top, it shall be securely fastened at the base and if fastening at the top is also impracticable, it shall have a man stationed at the foot holding the end to prevent it from slipping;
- q. Where a run of two or more ladders connects different floors, the ladders shall be staggered and a protective landing with the smallest practicable opening shall be provided at each floor;
- r. A ladder having only one upright or a missing or dangerously defective rung shall not be used;
- s. When a ladder is placed in position, the distance between the foot of a ladder and the base of the structure against which it rests shall be about one-quarter of its length;
- t. Workers using ladders shall leave at least one hand free for climbing up and down, face the ladder, avoid wearing slippery footwear and avoid carrying heavy or bulky loads;
- u. A ladder shall not be placed in front of a door that opens towards it unless the door is fastened or locked or guarded;
- v. A ladder shall not be placed against a window frame unless the ladder is fitted with a board at the top so that the applied load is safely distributed over the frame;
- w. Metal ladders shall not be used in the vicinity of live electrical equipment;
- x. Adequate means shall be provided to prevent displacement of the ladder set up in public thoroughfare or where persons, vehicles etc. may accidentally collide with it.

6.3. PORTABLE STEPLADDERS

- a. The length of portable stepladders shall not exceed 6 m and their back legs shall be adequately braced;
- b. Stepladders exceeding 1.5 m in length shall have two or more cross-ties;
- c. The spread between the front and back legs shall be restricted by means of hinged metal flat bars or high-grade fibre or other effective means;
- d. When in the open position, treads of stepladders shall be horizontal.

6.4. PORTABLE TRESTLE LADDERS

- a. The height of the trestle ladders shall not exceed 5.5 m;
- b. The spread between the front and back legs shall be restricted by means of hinged metal flat bars or high-grade fibre or other effective means;
- c. The front and back legs shall be joined at the top by bolted steel hinges of adequate dimensions or other effective means;
- d. Both legs of trestle ladders shall be equipped with sufficient number of steel crossties.

6.5. EXTENSION LADDERS

- a. The length of extension ladders shall not exceed 15 m;
- b. Extension ladders shall be equipped with an effective lock and guide brackets by which the ladder can be extended, retracted or locked in any position;

- c. The rungs of overlapping sections shall coincide so as to form double treads and shall be equipped with one or more extension ropes;
- d. Extension ropes shall be securely anchored and run over suitable pulleys.

6.6 MECHANICAL LADDERS

- a. Mechanical ladder is that ladder, which is a mechanically extendable ladder, mounted on a wheeled frame;
- b. Mechanical ladder shall be equipped with guard-rails and toe-boards and a cage of heavy-gauge steel mesh;
- c. If mechanical ladder has no railed platform or cage, workers using it shall be secured by suitable safety belt;
- d. Mechanical ladders shall not be moved, while a person is on them, unless they have specially designed to ensure that perfect stability is maintained during movement.

6.7. FIXED LADDERS

- a. Uprights of fixed ladders shall be at least 40 cm and shall be set an angle of 15° to the vertical;
- b. Clearance at the back of the rungs shall be at least 15 cm and no obstruction within 75 cm of the face of the ladder;
- c. There shall be at least 7.5 cm clearance between the ladder and the nearest fixed object;
- d. When it is necessary for a ladder to pass closely through a hole in a platform or a floor, the edges of the hole shall be padded so as to prevent injury to the users;
- e. The length of the runs of fixed ladder shall not exceed 9 m;
- f. Landing platform shall be provided for each 9 m or fraction thereof;
- g. As far as practicable, runs shall be staggered;
- h. Runs from which a person could fall from more than 6 m shall be enclosed in a cage of heavy-gauge mesh or hoops;
- i. Fixed ladders shall be firmly bolted or welded in position.

6.8. STAIRS

- a. Stairs shall be of adequate strength to withstand safely the loads that they will have to carry;
- b. Stairs used for the purpose of construction work shall have a clear width of at least 60 cm;
- c. Stairs made of perforated material shall not have openings exceeding 1.2 cm in width;
- d. No step of a stairway shall depend for its support solely on nails, spikes, screws or other similar fixing;
- e. No stairway with missing or dangerously defective steps shall be used;
- f. Every stairway that is at an angle of less than 30° from the vertical shall be provided with a secure handhold at the top landing place, either by extending one upright for at least 1 m or by other effective means;
- g. Movable and removable stairs shall be adequately secured in the position of use;
- h. In all building structures permanent stairs shall be constructed as soon as practicable;
- i. When work on a building has progressed to a height of more than 18 m above the ground and it has not been practical to construct the permanent stairs, sufficient number of stairs shall be provided to ensure safe access to the working levels.

7.0 SAFETY IN THE USE OF LIFTING APPLIANCES & GEARS

7.1. CONSTRUCTION AND MAINTENANCE OF LIFTING APPLIANCES:

All lifting appliances, including their parts and working gear, whether fixed or movable, and any plant or gear used in anchoring or fixing of such appliances -

- a. Shall be of sound construction, sound material, and of adequate strength to serve the purpose for which these are to be used and all such appliances shall be free from patent defects, and
- b. Maintained in good repair and working condition;
- c. Every drum or pulley around which the rope of any lifting appliance is carried, shall be of adequate diameter and sound construction in relation to such rope;
 - i. Any rope that terminates at the winding drum of lifting appliance shall be securely attached to such drum and at least three dead turns of such rope remain on such drum in every operating position of such lifting appliance;
 - ii. The flange of a drum projects twice the rope diameter beyond the last layer of such rope and if such rope and if such projection is not available, other measures like anti-slackness guards shall be provided to prevent such rope from coming off such drum;
- d. Every lifting appliance shall be provided with adequate and efficient brakes which shall be:
 - i) Capable of preventing fall of suspended load (including any test load),
 - ii) Effectively controlling such load while it is being lowered, acting without shock and shall be attached with shoes that can be easily removed for running and which shall be simple and have easily accessible means of adjustment;
- e. Provided that nothing contained above shall apply to **steam-winch** that can be operated as safely as with brakes.

7.2. CONTROLS OF EVERY LIFTING APPLIANCE SHALL BE SO;

- a. Situated that the driver of such appliance at his stand or seat has ample room for operating and has an unrestricted view of building or other construction work, as far as practicable, and that he remains clear of the load and the ropes, and that no load passes over him;
- b. Positioned with due regard to ergonomic considerations for proper operation of such appliance;
- c. Located that the driver of such appliance remains above the appliance and shall have upon them or adjacent to them clear markings to indicate their purpose and mode of operations;
- d. Provided, where necessary, with a suitable locking device to prevent accidental movement or displacement and shall move, as far as practicable, in the direction of the resultant load movement;
- e. Wherever automatic brakes are provided, they shall automatically come to the neutral position in case of power failure.

7.3. TEST AND PERIODICAL EXAMINATION

7.3.1 Test: all lifting appliances including all parts and gears thereof, whether fixed or movable, shall be tested and examined by a competent person before being taken into use for the first time or after it

has undergone any alteration or repairs liable to affect its strength or stability or after erection on a site and also once at least in every five years, in the manner as specified;

7.3.2. Examination: all lifting appliances shall be thoroughly examined by a competent person at least in every twelve months and where the competent person making such examination forms the opinion that the lifting appliance cannot continue to function safely, he shall forthwith give notice in writing of his opinion to the contractor.

7.4. AUTOMATIC LOAD INDICATOR

- a. Cut-out shall be provided which automatically arrests the movement of the lifting parts of every crane if the load exceeds the safe working load, wherever possible;
- b. Wherever the above provisions cannot be applied and if it is not possible to install an automatic safe load indicator, in that case, provision of a table showing the safe working loads at the corresponding inclinations or radii of the jib on the crane shall be considered sufficient.

7.5. INSTALLATION:

Fixed lifting appliances shall be installed by a competent person in a manner that

- a. Such appliances cannot be displaced by the load, vibration or other influences;
- b. The operator of such appliance is not exposed to danger from loads, ropes or drums;
- c. The operator can either see over the zone of operation or communicate with all loading and unloading points by signal, or other communication system;
- d. Adequate clearance is provided between parts or loads of lifting appliances and between the fixed objects such as walls and posts, or electrical conductors;
- e. The lifting appliances; when exposed to wind loading, are given sufficient additional strength, stability and rigidity to withstand such loading safely;
- f. No structural alterations or repairs are made on any part of the lifting appliances that affect the safety of such appliances without obtaining the opinion of the competent person to this effect.

7.6. WINCHES

- a. Winches shall not be used if their control levers operate with excessive friction or play;
- b. Double gear winches shall not be used unless a positive means of locking the gearshift is provided;
- c. There shall be no load other than the fall and the hook assembly on the winch while changing gears on a two-gear winch;
- d. Adequate protection shall be provided to the winch operator against abnormal weather;

- e. Temporary seats or shelters for winch operators that may pose hazard to the winch operator or any other building workers shall not be allowed to be used;
- f. Control levers shall be secured in the neutral position and, whenever possible, the power shall shut off if the winch is left unattended.

7.7. IN USE OF EVERY STEAM-WINCH

- a. Measures shall be taken to prevent escaping steam from obscuring any part of the construction site or other workplace or from otherwise hindering or injuring any building worker;
- b. Extension control levers which tend to fall off their own weight shall be counter-balanced;
- c. Winch operators shall not be permitted to use the which control extension levers except for short handles on wheel type controls and that such levers shall be of adequate strength, secure and fastened with metal connections at the fulcrum and at the permanent control lever;
- d. In use of every electric winch, no building worker shall be permitted to transfer, alter or adjust electric control circuits in case of any defect in such winch;

7.8. ELECTRIC WINCHES SHALL NOT BE USED FOR BUILDING WORK WHERE

- a. The electromagnetic brake is unable to hold the load; or
- b. One or more control points either hoisting or lowering are not operating properly.

7.9. BUCKETS:

It shall be ensured that tip-up buckets are equipped with a device that effectively prevents accidental tipping.

7.10. IDENTIFICATION AND MARKING OF SAFE WORKING LOAD:

- a. Every lifting appliance and loose gear shall be clearly marked for its safe working load and identification by stamping or other suitable means;
- b. Every derrick (**other than derrick crane**) shall be clearly marked for its safe working load when such derrick is used either in single purchase with lower block or in union purchases in all possible block positions;
- c. The lowest angle to the horizontal, to which the derrick may be used, shall be legibly marked;
- d. Every lifting appliance having more than one working load shall be fitted with effective means to enable the operator to determine safe working load at each point under all conditions of use;
- e. Means to ascertain the safe working load for lifting gears under such conditions in which such gears may be used shall be provided to enable a worker using such gears and such means safely, which shall comprise:
 - i) Marking of the safe working load in plain figures or letters upon the sling or upon a tablet or ring of durable material attached securely thereto in case of chain slings; and

- ii) The means specified or notices so exhibited as can be easily read by any concerned building worker stating the safe working load for the various sizes of the wire rope slings used.

7.11 LOADING OF LIFTING APPLIANCES AND LIFTING GEARS

- a. No lifting appliance, lifting gear or wire rope shall be used in an unsafe way and in such a manner as to involve risk to life of building workers and they are not loaded beyond their safe working load except for testing purposes under the direction of a **competent person** in the manner as specified in schedule;
- b. No lifting appliance and lifting gear, or any other material-handling appliance shall be used if the Inspector having jurisdiction under the Building and Other construction (regulation of employment and conditions of service) Act/Rules is not satisfied with reference to a certificate of test or examination or to an authenticated record maintained as provided under the Rules or if in his view the lifting appliance, lifting gear or any other material handling appliance is not safe for use in building or other construction work;
- c. No pulley block shall be used unless the safe working load and its identification are clearly marked on such block.

7.12. OPERATOR'S CAB OR CABIN SHALL

- a. Be made of fire resistant material;
- b. Have a suitable seat, a foot rest and protection from vibration;
- c. Afford the operator an adequate view of the area of operation;
- d. Afford the necessary access to working parts in the cab;
- e. Afford the operator adequate protection against the weather;
- f. Be adequately ventilated; and
- g. Be provided with a suitable fire extinguisher.

7.13. OPERATION OF LIFTING APPLIANCES:

Operator of every crane or lifting appliance shall possess adequate skill and training in the operation of the particular lifting appliances, provided further that

- a. No person under eighteen years of age shall be in control of any lifting machine, scaffold winch, or give signals to the operator;
- b. Precaution shall be taken by the trained operator to prevent lifting appliance from being set in motion inadvertently;
- c. The operation of lifting appliances shall be governed by signals in conformity with the approved standards;
- d. The operator's attention shall not be distracted while he is working;
- e. No crane, hoist, winch or other lifting appliance or any part of such crane, hoist, winch or other lifting appliance shall, except for testing purposes, be loaded beyond the safe working load;
- f. During the hoisting operation, effective precaution shall be taken to prevent any person from standing or passing under the load in such operation;

- g. Operator shall not leave lifting appliance unattended while power is on or the load is suspended to such appliance;
- h. No person shall ride on a suspended load of any lifting appliance;
- i. Every part of a load in course of being hoisted or lowered shall be adequately suspended and supported to prevent danger;
- j. Every receptacle used for hoisting bricks, tiles, slates or other material shall be suitably enclosed as to prevent the fall of any such material;
- k. The hoisting platform shall be enclosed when loose material or loaded wheel barrows are placed directly on such platform or lowering such materials or wheel barrows;
- l. No material shall be raised, lowered or slewed with any lifting appliance in such a way as to cause sudden jerks to such appliance;
- m. In hoisting a barrow, any wheel of such barrow shall not be used as a means of support unless adequate steps have been taken to prevent the axle of such wheel from slipping out of its bearing;
- n. Long objects like planks or girders shall be provided with tag line to prevent any possibility of danger while raising or lowering such objects;
- o. During the process of landing or material, a building worker shall not be permitted to lean out into empty space for finding out the loading and unloading of such material;
- p. When hoisting of load is done in an enclosed space, neither the lifting material nor the boom shall project outside the enclosed space;
- q. Adequate steps shall be taken to prevent a load, in the course of being hoisted or lowered from coming into contact with any object to avoid any displacement of such load and appropriate appliances provided and used for guiding heavy loads when raising or lowering heavy loads to avoid crushing of hands of building workers during such raising or lowering of loads.

7.14. HOISTS

- a. Hoist towers shall be designed according to the relevant national standards;
- b. Hoist shafts shall be provided with rigid panels or other adequate fencing at the ground level on all sides of such shafts and at all other levels on all sides of the access to such shafts while the walls of hoist shafts, except at approaches, extend at least two meters above the floor or platform of access to such shafts;
- c. Approaches to hoist shall be adequately lit and provided with gates that shall be guarded to maintain visibility at least of two meters height; and equipped with a device, which requires such gate to be closed before the platform of such hoist can leave the landing, and prevents the gate from being opened unless such platform is at the landing;
- d. The guides of hoist platforms shall offer sufficient resistance to bending and to bucking in the case of jamming, by providing a safety catch;
- e. Overhead beams and their supports are capable of holding the total maximum live and dead loads that such beams and supports will be required to carry, with a safety factor of at least five;

- f. A clear space shall be provided –
- i. Above the highest stopping place of a cage or platform to allow sufficient unobstructed travel of such cage or platform in case of over-winding and
 - ii. Below the lowest stopping place of such cage or platform;
- g. Adequate covering shall be provided above the top of hoist shafts to prevent materials from falling into such shafts;
- h. Outdoor hoist towers shall be erected on adequately firm foundations and securely braced, guyed and anchored;
- i. A ladder way shall extend from the bottom to the top of every outdoor hoist tower in case no other ladder way exists within easy reach and such ladder way shall comply with the relevant national standards;
- j. The rated capacity of a hoisting engine shall at least be one and a half times the maximum load that such engine will be required to move;
- k. All gearing on a hoisting engine shall be securely enclosed;
- l. Steam piping of hoisting engine shall be adequately protected against accidental contact of such piping with a building worker;
- m. Electrical equipment of a hoisting engine shall be effectively earthed;
- n. A hoist shall be provided with suitable devices to stop a hoisting engine as soon as the platform of such hoist reaches its highest stopping place;
- o. A hoisting engine shall be protected by suitable cover against weather and falling objects;
- p. A hoisting engine set up in a public thoroughfare shall be completely enclosed;
- q. All exhaust steam pipes shall discharge steam in such a manner that the steam so discharged does not scald any person or obstruct the operator's view;
- r. The motion of a hoist shall not be reversed without first bringing it to rest to avoid any harm from such reverse motion;
- s. A hoist not designed for the conveyance of persons shall not be set in motion from the platform of such hoist;
- t. Pawls and ratchet wheels of a hoist, requiring disengagement of such pawls from such ratchet wheels, before the platform of such hoist is lowered, shall not be used;
- u. A platform of a hoist shall be capable of supporting such maximum load that such platform may carry with a safety factor of at least three;
- v. A platform of a hoist shall be equipped with suitable safety gear which can hold such platform with its maximum load in case its hoisting rope breaks;
- w. On platform of a hoist, the wheel barrows or truck shall be efficiently blocked in safe positions;

- x. A cage of a hoist or platform where the building workers are required to enter into such cage or to go on such platform at landing levels, shall be provided with a locking arrangement to prevent such cage or platform from moving during the time a worker enters or leaves such cage or platform;
- y. The sides of platform of a hoist which are not used for loading or unloading, shall be provided with toe-board and enclosures of a wire mesh or any other suitable means to prevent the fall of any part of a load from such platform, further provided that
 - i. The platform of a hoist, which has any probability of falling of any part of a load from it, shall be provided with an adequate covering to prevent such fall;
 - ii. The counter weights of a hoist consisting of an assemblage of several parts shall be so constructed that such parts shall be rigidly connected together;
 - iii. The counter weights of a hoist shall run between guides;
 - iv. At every level of work the building workers shall be provided with adequate platforms for performing such work;
 - v. A legible notice in Hindi as well as in a local language shall be displayed in a conspicuous place of the platform of a hoist and that such notice shall state the maximum carrying capacity of such hoist in kilograms on the hoisting engine;
 - vi. On a hoist authorized and certified for the conveyance of the persons on the platform or in the cage and such notice shall state the maximum number of persons to be carried on such hoist at one time;
 - vii. On a hoist carrying goods and other materials such notice shall state that such hoist is not meant for carriage of persons.

7.15. FENCING AND MEANS OF ACCESS TO LIFTING APPLIANCES

- a. Safe means of access shall be provided to every part of lifting appliances;
- b. The operator's platform on every crane or tip driven by mechanical power shall be securely fenced and provided with safe means of access and where access to such platform is by a ladder, the sides of such ladder shall extend to a height reasonable beyond such platform or some other suitable handhold shall be provided in the platform;
- c. The handling place on such platform shall be maintained free from obstruction and slipping; and
- d. In case the height of such ladder exceeds six meters, the resting platforms shall be provided on such ladder at every six meters of its height and where the distance between last platform so provided and the top end of such ladder is more than two meters then on such top end.

7.16. RIGGING OF DERRICKS:

Every derrick shall have current and relevant rigging plans and any other information necessary for the safe rigging of such derrick and its gear.

7.17. SECURING OF DERRICK FOOT:

Appropriate measures shall be taken to prevent the foot of a derrick from being lifted out of its socket or supports.

7.18. CONSTRUCTION AND MAINTENANCE OF LIFTING GEAR

- a. Every lifting gear shall be –
 - i. of good design and construction, sound material and adequate strength to perform the work for which it is used;
 - ii. free from patent defects; and
 - iii. properly maintained in good repair and working order;
- b. Components of the loose gear, at the time of its use, shall be renewed if one of its dimensions at any point has decreased by ten per cent or more;
- c. A chain shall be withdrawn from use when it is stretched and increased in length which exceeds five per cent of its length or when a link of such chain is deformed or is otherwise damaged or defects in the welds have appeared on it;
- d. Rings, hooks, swivels and end links attached to a chain shall be of the same materials as that of such chain;
- e. The voltage of electric supply to any magnetic lifting device shall not fluctuate by more than **plus** or **minus** 10%.

7.19. TEST AND PERIODICAL EXAMINATION OF LIFTING GEARS

- a. A lifting gear shall be initially tested for the manufacturer by a competent person in a manner specified as per schedule annexed before taking into use or after undergoing any substantive alterations which renders its any part liable to affect its safety and such gear after such test shall subsequently be retested for the use of its owner at least once in every five years;
- b. A lifting gear in use shall thoroughly examined once at least in every twelve months by a competent person;
- c. A chain in use shall be thoroughly examined at least once every month by a responsible person for its use;
- d. Certificates of initial and periodical test and examinations of loose gears shall be obtained in the form annexed.

7.20. ROPES

- a. No rope shall be used for building or other construction work unless -
 - i) It is of good quality and free from patent defects; and
 - ii) In the case of wire rope, it shall be tested and examined by a competent person in the manner annexed;
 - iii) Every wire rope of lifting appliance or lifting gear used for building or other construction work shall be inspected by a responsible person for such use, once at least in every three month;

- b. Provided that after if any such wire is broken in such rope, the responsible person shall thereafter inspect it once at least in every month and ensure that;
- c. No wire rope shall be used for building or other constructing work if in any length of eight diameters of such wires, the total number of visible broken wires exceed ten per cent of the total number of wires in such rope, or such rope shows signs of excessive wear, corrosion or other defects which in the opinion of the person who inspects it, is unfit for use;
- d. Eye splices and loops of ropes for the attachment of hooks, rings and other such parts to wire rope shall be made with suitable thimble;
- e. A thimble or loop splice made in any wire rope sling shall conform to the following standards, namely:
 - i) Wire rope sling shall have at least three tucks with full strand of rope and two tucks with one-half of the wires cut out of each of such strand in all cases, such strands shall be tucked against the lay of the rope;
 - ii) Protruding ends of such strands in any splice of wire rope slings shall be covered or treated so as to leave no sharp points;
 - iii) A fiber rope or a rope sling shall have at least four tucks, tail of such tuck being whipped in a suitable manner; and
 - iv) A synthetic fiber rope or rope sling shall have at least four tucks with full strands followed by further tuck with one-half filaments cut out of each of such strand and final tuck with one-half of the remaining filaments cut out from such strands. Any portion of the splices containing such tucks, with reduced number of filaments, shall be securely covered with suitable tape or other materials;
 - v) Provided further that nothing contained above shall apply where any other form of splice, which may be shown to be as efficient as the splice with above standards, shall be used.

7.21. HEAT TREATMENT OF LIFTING GEARS

- a. All chains other than bridle chains attached to derricks and all rings, hooks, shackles and swivels used in hoisting or lowering of such derricks shall be effectively annealed under supervision of a competent person and at the following intervals, namely:
 - i) Such chains, rings, hoods, shackles and swivels which are not more than twelve and a half millimeter of length annealed at least once in every six months; and
 - ii) All other such chains rings hooks shackles and swivels shall be so annealed at least once in every twelve months;
- b. Provided that the clause (a) above shall not apply to -
 - i) Pitched chins, working on sprocket or sprocket wheels;
 - ii) Rings, hooks and swivels permanently attached to pitched chains, pulley blocks or weighing machines, and
 - iii) Hooks and swivels having ball bearings or other case hardened parts;

- c. A chain or a loose gear made of high tensile steel or alloy steel shall be plainly marked with a mark indicating that it is so made;
- d. No chain or loose gear made of high tensile steel or alloy steel shall be subjected to any form of heat treatment except where such treatment is necessary for the purpose of repair of such chain or loose gear and that such repair shall be made under the direction of the competent person;
- e. That the wrought iron gear, the past history of which is not traceable, shall be suspected of being heat treated at incorrect temperature shall be normalized before using it on any building or other construction work.

7.22. CERTIFICATE TO BE ISSUED AFTER ACTUAL TESTING AND EXAMINATION ETC:

A competent person shall issue a certificate after actual testing or examination of the apparatus specified and record of such test or examination shall be maintained for inspection.

7.23. REGISTER OF PERIODICAL TEST, EXAMINATION AND CERTIFICATION THEREOF

- a. A register in the form annexed shall be maintained and particulars of such test and examination of lifting appliances, lifting gears and heat treatment as required shall be entered in such register;
- b. Certificate in respect of each of the following shall be obtained from a competent person:
 - i) In cases of initial and periodical test and examination of the lifting appliances such as Winches, Derricks and their accessory gears, Cranes or Hoists and their accessory gears;
 - (ii) In case of test, examination and re-examination of loose gears;
 - (iii) In case of test and examination of wire ropes;
 - (iv) In case of heat treatment and examination of loose gears;
 - (v) In case of annual thorough examination of the loose gears, except where required particulars of such exemption have been enclosed in the register referred to in Form annexed and such certificates are attached to the register referred to as above and certificates kept at such construction site in case such register and certificate relate to lifting appliances, loose gear and wire ropes and
- c. Produced on demand and retained for at least five years after the date of the last entry made in such register;
- d. No lifting appliance or lifting gear in respect of which an entry is required to be made in register referred to above and certificate of test and examination are required to be attached in such register in the manner as specified, shall be used for building or other construction work unless the required entries have been made in such register and certificates.

7.24. VACUUM AND MAGNETIC LIFTING GEAR

- a. No vacuum lifting gear, magnetic lifting gear or any other lifting gear where the load on it is held by adhesive power, shall be used while workers are performing operations beneath such gear;
- b. A magnetic lifting gear used in connection with building or other construction work shall be provided with an alternative supply of power, such as batteries, which may come into operation immediately in the event of failure of the main power supply;

- c. No building worker shall work within the swinging zone of the lifting gear or load or building or other construction material suspended to such lifting gear.

7.25. KNOTTING OF CHAINS AND WIRE ROPES:

No chain or wire rope with a knot in it shall be used in building or other construction work.

7.26. CARRYING OF PERSONS BY MEANS OF LIFTING APPLIANCES ETC.

- a. No building worker shall be raised, lowered or carried by a power driven lifting appliance, except
 - i. On the drive's platform in the cage of a crane; or
 - ii. On a hoist; or
 - iii. On an approved suspended scaffold;
- b. Provided that a building worker may be raised, lowered or carried by a power driven lifting appliance:
 - i. In circumstances where the use of a hoist or of a suspended scaffold shall not reasonably be practicable, or
 - ii. On an aerial cableway or aerial ropeway, provided further that the following requirements are met:
 - iii. That the appliance referred to above can be operated from one position only and that
 - iv. Any winch used in connection with the appliance shall also comply with the requirements as laid down above.
- c. The appliance referred to above shall not carry any person except:
 - i. In a chair or cage,
 - ii. In a skip or other receptacle at least three feet deep which shall be suitable for safe carriage of a person and any such chair, cage, skip or other receptacle shall be made of good construction, sound material, and adequate strength and properly maintained with suitable means to prevent any occupant therein from falling out of it and shall be free from any material or tools which may interfere with the handhold or foothold of such occupant or otherwise endanger him; and
 - iii. Those suitable measures shall be taken to prevent the chair, cage skip or other receptacle from spinning or tipping in a manner dangerous to any occupant therein.

7.27. HOISTS CARRYING PERSONS

- a. No building worker shall be carried with the help of a hoist unless it is provided with a cage which:
 - i) Is so constructed as to prevent, when its gates are shut, any building worker carried by such hoist from falling out of it or from being trapped between any part of such cage and any fixed structure or other moving part of such hoist or from being struck by articles or materials falling down the hoist way on which such hoist is moving; and
 - ii) Is fitted on each of its side from which access is provided to a landing place with a gate which has efficient interlocking or other devices to secure so that such gate cannot be opened except when such cage is at a landing place and that such cage cannot be moved away from any such place until such gate is closed;

- b. Every gate in the hoist way enclosure of such hoist used for carrying persons shall be fitted with efficient interlocking or other devices to secure so that such gate cannot be opened except when the cage of such gate is at the landing place and that such cage cannot be moved away from the landing place until such gate is closed;
- c. In every hoist used for carrying building workers there are provided with suitable and efficient automatic devices to ensure that the cage of such hoist comes to rest at a point above the lowest point to which such gave may travel.

7.28. ATTACHMENT OF LOADS

- a. When a sling is used to hoist long materials, a lifting beam shall be used to space the sling legs for proper balance and when a load is suspended at two or more points with slings, the eyes of the lifting legs of such slings shall be shackled together and such shackled or eyes of the shackled slings shall be placed on the hook or the eyes of such lifting legs shall be shackled directly to the hoisting block, ball or balance beam, as the case may be;
- b. Every container or receptacle used for raising or lowering stone, bricks tiles, slates or other similar objects shall be so enclosed with the hoist as to prevent the fall of such objects;
- c. A loaded wheel barrows placed directly on a platform of a hoist for raising or lowering of such wheel barrows shall be so secured that such wheel barrows cannot move and such platform shall be enclosed to prevent the fall of the contents kept in such wheel barrows;
- d. Landings of hoists shall be so designed and arranged that building workers on such hoist be not required to lean out into empty space for loading and unloading on any material from such hoist

7.29. TOWER CRANES

- a. No person other than the operator trained and capable to work at heights shall be employed to operate tower cranes;
- b. The ground on which a tower crane stands shall have adequate bearing capacity;
- c. Bases for tower cranes and trucks for rail mounted tower cranes shall be firm and leveled and such cranes erected at a reasonably safe distance from excavations and operated within gradient limits as specified by the manufacturer of such cranes;
- d. Tower cranes shall be sited where there is a clear space available for erection, operation and dismantling of such cranes;
- e. Tower cranes shall be sited in such a way that the loads on such cranes shall not be handled over any occupied premises, public thoroughfares, railways or near power cables, other than construction works for which such cranes are used;
- f. Where two or more tower cranes are sited and operated, every care shall be taken to ensure positive and proper communication between operators of such cranes to avoid any dagger or dangerous occurrences;
- g. Tower cranes shall not be used for loading magnet, or demolition ball service, piling operation or other similar operations which could impose excessive load stresses on the crane structure of such cranes;

- h. The instruction of the manufacturer of a tower crane and standard safe practices regarding such cranes shall be followed while operating or using such cranes.

7.30. QUALIFICATION OF OPERATOR OF LIFTING WINCHES AND OF SIGNALER ETC.

- a. No person shall be employed to drive or operate a lifting appliance whether driven by mechanical power or otherwise or to give signals to driver of operator of such lifting appliance or to work as an operator of a rigger or derricks unless he is
 - i) Sufficiently competent and reliable;
 - ii) Possesses the knowledge of the inherent risks involved in the operation of lifting appliance;
 - iii) Medically examined periodically as specified and
 - iv) Is above eighteen years of age.

8.0 SAFETY IN THE USE OF TRANSPORT, EARTHMOVING EQUIPMENT & OTHER CONSTRUCTION MACHINERY

8.1 EARTHMOVING EQUIPMENT AND VEHICLES

- a. All vehicles and earthmoving equipment shall be made of good material, proper design and sound construction and be sufficiently strong for the purpose for which such equipment are properly used in accordance with standard safe operating practices;
- b. Provided that the truck or trailer employed for transporting freight containers shall be of the size sufficient to carry the containers, without over hanging and provided with twist locks conforming to approved standards, at all the four corners of each of such use by an authority under the relevant law for the time being in force and is inspected by a responsible person, at least once in a month and record of such inspection shall be maintained:
- c. All transport or earth moving equipment and vehicles shall be inspected at least once a week by a responsible person and in case any defect is noticed in such equipment or vehicle it shall be immediately taken out of use;
- d. Power trucks and tractors shall be equipped with effective brakes, headlights and tail lamps and maintained in good repair and working order;
- e. Side stanchions on power trucks and trailers for carrying heavy and long objects shall be
 - i. Of sound construction and free from defects;
 - ii. Provided with tie chains attached to the top across the loads for preventing such stanchions from spreading out; and
 - iii. Kept in position while loading and unloading;
 - iv. Safe gangways provided for to and fro movement of building workers engaged in loading and unloading of lorries, trucks, trailers and wagons;
 - v. Trucks and other equipment shall not be loaded beyond their safe capacity and carry workers engaged in loading and unloading of lorries, trucks trailers and wagons in an unsafe condition;
 - vi. Handles of trucks shall be so designed as to protect the hands of the building workers working on such trucks, or such handles provided with knuckle guards;
 - vii. No unauthorized person shall ride the transport equipment employed in such work;
 - viii. A driver of a transport equipment shall maneuver such equipment under the direction of a signaler;
 - ix. Adequate precaution such as isolating the electric supply or erecting overhead barriers of a safe height shall be taken when earth moving equipment or vehicles are required to operate in dangerous proximity to any live electric conductor;
 - x. Vehicles and earth moving equipment shall not be left on a slope with the engine of such vehicles or equipment running;

- xi. All earth moving equipment, vehicles or other transport equipment shall be operated only by such person who are adequately trained and possess such skills as required for safe operation of such equipment, vehicle or other transport equipment.

8.2. POWER SHOVELS AND EXCAVATOR

- a. A shovel or an excavator whether operated by steam or electric or by internal combustion, shall be constructed, installed, operated, tested and examined as per approved standards;
- b. Excavator equipped for use as a mobile crane shall be examined and tested in accordance with the requirements for such mobile cranes as laid down by the manufacturer; and
- c. Fitted with an automatic safe working load indicator;
- d. Buckets or grabs of power shovels shall be propped to restrict the movement of such buckets or grabs while being repaired or while the teeth of such buckets or grabs are being changed.

8.3. BULLDOZER

- a. Operator of every such bulldozer before leaving the dozer shall take the following steps:
 - i) Apply the brakes;
 - ii) Lower the blade and sipper and
 - iii) Put the shift lever into neutral;
 - iv) Dozer left on level ground at the close of the work for which such bulldozer is used;
 - v) The blade of a bulldozer kept low when such bulldozer is moving uphill;
 - vi) The bulldozer blades not used as brakes except in an emergency.

8.4. SCRAPERS

- a. A tractor and scraper shall be joined by safety line at the time of its operation;
- b. The scraper bowls shall be propped while blades of such scraper are being replaced;
- c. A scraper moving downhill shall not be left in gear.

8.5. MOBILE ASPHALT LAYERS & FINISHERS

- a. A mixture elevator shall be located within a wooden or sheet metal enclosure with a window for observation, lubrication and maintenance;
- b. Bitumen scoops shall have adequate covers;
- c. When asphalt plants are working on public road, adequate traffic control shall be established on such road and the building workers working with such plant provided with reflective jackets;
- d. A sufficient number of fire extinguishers shall be kept in readiness at such workplace where fire hazards may exist;
- e. The materials shall be loaded on the elevator after the drying drain has warmed up of such elevator;
- f. No open light shall be used for ascertaining the level of asphalt;

- g. Inspection opening shall not be opened till there is a pressure in the boiler, which may cause injury to building workers.

8.6. PAVERS:

Pavers shall be equipped with guards suitable to prevent building workers from walking under the skip of such pavers.

- 8.7. Road rollers:** Before a road roller is used on the ground, such ground shall be examined for its bearing capacity and general safety, especially at the edges of slopes such as embankment on such grounds and shall not be moved downhill with the engine out of gear.

8.8. GENERAL SAFETY IN RESPECT OF POWERED CONSTRUCTION MACHINERY

- a. Every vehicle or earthmoving equipment shall be equipped with -
 - i) Silencers;
 - ii) Tail lights
 - iii) Power and hand brakes;
 - iv) Reversing alarm; and
 - v) Search light for forward and backward movement, which are required for safe operation of such vehicle or earthmoving equipment;
- b. The cab of vehicle or earthmoving equipment shall be kept at least one meter from the adjacent face of a ground being excavated;
- c. When cranes or shovel are traveling, the boom of such crane or shovel shall be in the direction of such travel and the bucket or scoop attached to such crane or shovel raised and without load except when such traveling is downhill.

9.0 SAFETY IN THE PROVISION OF RUNWAYS AND RAMP

9.1. USE OF RUNWAYS AND RAMPS:

- a. Runway or ramps shall not be less than 430 mm in width and constructed of not less than 25 mm thick planking or any other material of adequate strength to withstand the required load, supported substantially in relation to the span and braced with such runway or ramp, and design and construction of such runway or ramp shall be in accordance with the approved standards;
- b. Every runway or ramp located more than 3 m above the floor or ground shall be on open sides and provided with a guardrail of adequate strength and height of not less than 1 m.
- c. Use of runways and ramps by vehicles:
 - i. All runways and ramps shall be of sound construction, strength and securely braced and supported;
 - ii. Every runway or ramp for the use of transport equipment like trailers, trucks or heavier vehicles shall have a width of not less than 3.7 m and provide with timber curbs or any other material of adequate strength with not less than 200 mm by 200 mm in width placed parallel to, and secured to, the sided of such runway or ramp and such runways or ramps or ramps shall be designed in accordance with the approved standards.

9.2. SLOPE OF RAMPS:

Every ramp shall have a slope not exceeding one in four and the total rise of a continuous ramp used by building workers carrying material or using wheelbarrows shall not exceed 3.7 m, unless broken by horizontal landing of at least 1.2 m in length.

9.3. USE OF RUNWAYS OR RAMPS BY WHEELBARROWS, ETC.

- a. Every runway or ramp used for wheelbarrows and carts or hand trucks shall not be less than 1 m width and constructed of not less than 50 mm thick planking, and supported and braced suitably for such use;
- b. Every runway or ramp located more than 3 m above the floor or ground shall be provided on the open sides with suitable guardrails of adequate strength.

10. SAFETY IN HANDLING AND USE OF EXPLOSIVES

10.1 GENERAL PROVISIONS:

- a. The use of explosives shall be carried out in a safe manner to avoid injury to any person and under the direct supervision of a responsible person;
- b. No person other than authorized and competent one shall be allowed to handle and use explosives;
- c. Before using any explosive, necessary warning and danger signals shall be erected, at conspicuous places of such use to warn the building workers and the general public of the danger involved in such use.
- d. No person other than authorized and competent one shall be allowed to handle and use explosives.
- e. Smoke, open lamps, other type of hot or heat producing items and sparks shall be prohibited in or near explosives magazines or while explosives are being handled, transported or used.
- f. No person shall be allowed to handle or use explosives while under the influence of intoxicating liquors or dangerous drugs.
- g. The explosives shall be accounted for at all times. No explosives or blasting agents shall be abandoned.
- h. No fire shall be fought where the fire is in the imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area shall be guarded against intruders.
- i. Employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including but not limited to visual and audible warning signals, flags, or barricades to ensure employee safety.
- j. Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by induced voltage, lightning, adjacent power lines, dust storms, or other sources of extraneous electricity or otherwise. These precautions shall include:
- k. Short-circuiting of detonators in holes, which have been primed and shunted until wired into the blasting circuit.
- l. The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electric storm.
- m. The prominent display of adequate signs, warning against the use of radio transmitters, on all roads within 1000 ft of blasting operations. Whenever adherence to the 1000 ft distance would create an operational handicap, a competent and expert person shall be consulted to evaluate the particular situation, and an alternative provided, which are adequately designed to prevent any premature firing of electric blasting of caps. A description of any such blasting shall be reduced to writing and shall be certified as meeting the purposes of this subdivision by the competent person consulted. The description shall be maintained at the construction site during the duration of the work, and shall be available for inspection.

- n. Empty boxes and paper and fiber packing materials, which have previously contained high explosives, shall not be used again for any purpose, but shall be destroyed by burning at an approved location.
- o. Explosives, blasting agents and blasting supplies that are obviously deteriorated or damaged shall not be used.
- p. Delivery and issue of explosives shall only be made authorized persons into authorized magazines or approved temporary storage or handling areas.
- q. Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not be carried on until the operators and/or owners have been notified and measures for safe control have been taken. In such situations controlled blasting shall be restored to.
- r. All loading and firing shall be directed and supervised by competent persons thoroughly experienced in this field.
- s. Loaded boreholes shall not be left unattended after the end of the shift.
- t. Suitable and sufficient means of egress to ground level shall be provided in all cases of excavations, trenches, all other places where explosives are handled above or below ground level.
- u. At an appropriate time before the final blasting warnings, workers in the area shall be removed to a designated safe place.
- v. An unmistakable, audible, final warning shall be sounded one minute prior to the detonation of explosives; after completion, when the person in charge has established that safe conditions prevail, an "all clear" shall be sounded.
- w. To prevent persons entering any danger zone during blasting operations notices shall be given to all concerned.
- x. Notices referred above shall indicate:
 - i. that explosives are in use;
 - ii. the audible warning sound and the "all clear" and state when they will be sounded; and
 - iii. the warning flags in use, including an "all clear" flag.
- y. Precautions against lightning shall be provided in accordance with the Indian Electricity Act and Indian Explosives Act and Rules and regulations framed there under.
- z. Package containing explosives shall not be dragged, dropped or handled roughly.
 - aa. Non-sparking tools shall be used to open keys.
 - bb. The explosives shall not be carried in the box or otherwise on any individual.
 - cc. Nothing shall be inserted in the open end of the blasting cap except fuses.

- dd. Deteriorated or damaged explosives shall not be used but shall be disposed or destroyed strictly in accordance with the approved methods and in the doing so the manufacturers or the appropriate authority's instructions shall be followed.
- ee. lightning shall be in accordance with Indian Electricity Act/Rules

10.2. TRANSPORTATION OF EXPLOSIVES

- a. Keep safe distance and to use non-sparking tools while opening packages containing explosives;
- b. Stop the use of explosives and handling thereof while the weather conditions are not suitable for such use or handling;
- c. Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by induced voltage, lightning, adjacent power-lines, dust storms or other sources of extraneous electricity or otherwise. These precautions shall include –
 - i. Suspension of all blasting operations and evacuation of persons;
 - ii. All warning signs shall be displayed within 200 m of blasting operations and in case putting up a sign at 200 m is impractical, the contractor shall consult the Engineer-in-charge for alternatives;
 - iii. All loading and firing shall be directed and supervised by competent persons thoroughly experienced in the field;
 - iv. To prevent persons entering any danger zone during blasting operations, notices shall be given to all concerned;
- d. In addition to these provisions, all measures and precautions that are required to be observed for use, handling, storing or transportation of explosives under the Rules framed under the Explosives Act, 1884 (4 of 1884) shall be observed;
- e. All the relevant statutory provisions, local laws and rules and regulations shall be complied with.
- f. Where the magazine is located near the construction site and blasting operation continues daily, actual requirement of explosives shall be drawn from the magazine and transported to the site. Any leftovers shall be returned to the magazine each time after the blast. In case of work at scattered places and for a small duration, portable magazines shall be used and kept within a fence in safe place and properly guarded.
- g. For carrying higher quantity (more than 5 kg of explosives) specially designed insulated containers shall be used. These containers shall be constructed of finished wood not less than 5cm thick or plastic not less than 6mm thick or pressed fibre not less than 10mm thick. There shall be no metal parts (not even nails, bolts, screws etc.) and the containers shall be provided with suitable non-conductive carrying device, such as rubber, leather or canvas handle or strap.
- h. Vehicles to be used for transportation explosives shall be in good working condition and shall have a tight wooded or non-sparking metal (copper, brass and the like) floor with sides and

ends high enough to prevent the explosives from falling off the vehicle. In open bodied vehicles, the explosives shall be covered with a waterproof and fibre tarpaulin.

- i. Electrical wiring in vehicle shall be fully insulated so as to prevent the danger of short-circuiting and at least two fire extinguishers of carbon dioxide type shall be carried. The vehicle shall be properly marked indicating adequate warning to the public in regard to the nature of cargo.
- j. No metals except approved metal truck shall be allowed to come in contact with cases of explosives, metal, flammable, or corrosive substance shall not be transported with explosives. As far as possible, transportation of any material along with explosives shall be prohibited.
- k. Smoking shall be prohibited in the vehicle carrying explosives.
- l. No unauthorized person shall be allowed in the vehicle, carrying explosives.
- m. Loading and unloading of explosives shall be done carefully.
- n. Explosives and detonators or blasting caps shall not be permitted to be transported in the same vehicle.
- o. Detonators and other explosives for blasting shall be transported to the site of work in the original containers or in securely locked separate non-metallic containers and shall not be carried loose or mixed with other materials.

10.3. STORAGE OF EXPLOSIVES AND BLASTING AGENTS

- a. Explosives and related materials shall be stored in approved facilities.
- b. Blasting caps, electric blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives or blasting agents.
- c. Smoking and open flames shall not be permitted within 50 feet of explosives and detonators storage magazine.
- d. No Explosives or blasting agents shall be permanently stored in any underground area until the area has been developed to the point where at least two modes of exit have been provided.
- e. Permanent underground storage magazine shall be at least 300 feet from any shaft or other active under ground working area.
- f. Permanent underground magazines containing detonators shall not be located closer than 50 feet to any magazine containing other explosives or blasting agents.

10.4. DRILLING AND LOADING

- a. Before planning out the drilling operations for blasting purposes, nature of stratum and the over burden shall necessarily be examined to avoid possibilities of landslides after blasting.
- b. The face or rock shall be carefully examined before drilling to determine the presence of unfired explosives. No attempt shall be made to drill at a site if un-detonated explosives are suspected. In such case the boreholes shall be thoroughly cleaned before a cartridge is

inserted. Wooden tamping rods (not pointed, but cylindrical throughout) shall be used in the charging the holes. The cartridge will be on the top.

- c. The borehole shall be carefully checked for length, presence of water dust, etc. with a wooden temping pole or a measuring tape before loading.
- d. Surplus explosives shall not be stacked near working areas during loading/unloading.
- e. The line of detonating fuse extending into a borehole shall be cut from the spool before loading the remainder of the charge.
- f. A bore shall not be loaded with explosives after springing (enlarging the hole with explosives) or upon completion of drilling without making sure it is cool and it does not contain any hot smoldering material. Temperatures in excess of 65° C are dangerous.
- g. A bore near another hole loaded with explosives shall not be sprung.
- h. No force shall be used for inserting cartridges or any explosives into a bore hold or pass any obstruction in a borehole.
- i. No force shall be used for inserting a blasting cap or an electric blasting cap into explosive. The cap shall be inserted into a hole made with a pickers designed for the purpose. A hitch of the electric blasting cap leading wire shall be made on the primer cartridge so as to prevent pulling out the electric blasting cap from the explosive charge. In case of fuse, the fuse shall be tied to the explosive cartridge so that the blasting cap is not pulled out. Care shall be taken so that the blasting cap is not pulled out. Care shall be taken so that the electric blasting cap, leading wire or the length of the fuse does not get damaged during loading of the charge.
- j. No attempt shall be made to slit, drop, deform or abuse the primer.
- k. Blasting caps or electric blasting caps shall not be connected to detonating fuse except by methods recommended by the manufacturers of caps.
- l. Explosive cartridge shall not be cut, nor explosive removed from the cartridge for use.
- m. Metallic devices of any kind shall not be used in tamping. Wooden tamping tools with not exposed metal parts except non-sparking metal connectors for jointed poled shall be used. Violent tamping shall be avoided. Primer shall not be tamped.
- n. Care shall be taken to confine the explosives in the bore hold with sand, earth clay or other suitable combustible stemming material.
- o. Kinking or injuring of fuse or electric blasting cap wires shall be avoided when tamping.

10.5. ELECTRICAL SHOT-FIRING CIRCUIT

- a. In deciding the sizes of wires, fuses, circuits, blasting switches, etc., instructions issued by the manufacturers of these articles shall be followed, if they do not contradict with Indian Explosives Act or framed under it.
- b. No person shall attempt to uncoil the wires and open out the short-circuited bare leading wires of the electric blasting cap during approach of dust storm or near any source of large

charge of static electricity or near a radio transmitter. The manufacturer of the cap or the Inspectorate of Explosives shall be consulted regarding the distance from the transmitter beyond which electric short firing shall be conducted.

- c. Firing circuit shall be kept completely insulated from the ground of the other conductors, such as wires, rails, pipes or other paths or stray current.
- d. There shall not be any electric live wires or cables of any kind near electric blasting caps or other explosives except at the time and for the purpose of firing the blast.
- e. All electric blasting caps shall be tested singly and also when connected in a circuit in series using only an approved type of circuit continuity tester or ohmmeter.
- f. No attempt shall be made to use in the same circuit either electrical blasting caps made by more than one manufacturer or electric blasting caps of different design or function even if made by the same manufacturers unless such use is approved by the manufacturers.
- g. No attempt shall be made to fire a circuit of electric blasting caps with less than the minimum current specified by the manufacturer of that electric blasting cap.
- h. Care shall be taken to ensure that all wire ends to be connected are bright and clean.
- i. The electric cap wires or leading wires shall be kept short circuited until ready to fire.
- j. When energy for blasting is taken from power circuits the voltage shall not exceed 220v. The wiring controlling arrangements shall conform to the following:
- k. The blasting switch shall be strictly according to the specifications, externally operated double-throw switch, which when locked in the open position will short circuit and ground the leading wires. The switch shall be installed at the location where the firing is to be controlled.
- l. A 'safety' switch of the same type as the blasting switch shall be installed between the blasting switch and the firing circuit and lead lines, at a distance not to exceed 180cm from the blasting switch.
- m. Both the safety switch and the blasting switch shall be locked in the open position immediately after the shot and before any person is permitted to return to the blasting area. Key to the switches shall remain in the possession of the blaster at all times.
- n. Rubber covered or other adequately insulated copper wires in good condition shall be used for firing lines and shall have solid cores of appropriate gauge. Sufficient firing line shall be provided to permit the blaster to be located at a safe distance from the blast. Single conductor lead lines shall be used.
- o. Blasting operations in the proximity of overhead power lines, communication lines, utility lines, or other structures shall not be carried on until the operator or the owner, or both of such lines as been notified and precautionary measures deemed necessary, have been taken.
- p. All holes loaded on a shift shall be fired on the same shift.
- q. As far as possible, blasting shall be carried out using suitable exploder with 25 per cent excess capacity. Electric power from the mains shall be used only when it is absolutely necessary.

10.6. SHOT-FIRING WITH SAFETY FUSE

- a. The fuse shall be carefully handled to avoid damaging the covering. In very cold weather the fuse shall be slightly warmed before using so as to avoid cracking the waterproofing.
- b. Short fuse shall not be used. The length of a fuse shall not be less than 120cm. The rate of burning of the fuse shall be known and it would be necessary to make sure that it will take sufficient time in burning so as to enable all persons to reach a place of safety. The burning rate of the fuse shall not be more than 60 cm/min.
- c. The fuse shall not be cut until the operation to insert the fuse into a blasting cap is ready. The fuse shall be cut off about 2.5 to 5 cm to ensure a dry end. It shall be cut squarely across with a clean and sharp blade. The fuse shall be seated lightly against the cap charge and care shall be taken to avoid twisting after it has been placed in position.
- d. Blasting caps shall not be crimped by any means except by a cap crimper designed for the purpose. It shall be necessary to make sure that the cap is squarely crimped to the face.
- e. The fuse shall be lighted with a fuse lighter designed for the purpose. If a match is used, the fuse shall be slit at the end and the match head held in then slit against the power core and then the match head rubbed against an abrasive surface to light the fuse.
- f. The fuse shall not be lighted until sufficient stemming has been placed over the explosives to prevent sparks of live match heads from coming into contact with the explosives.
- g. The explosives shall not be held in hands when lighting the fuse.

10.7. UNDERGROUND WORK

- a. Only permissible explosives and in the manner as specified by the appropriate authority shall be used.
- b. Excessive quantities of explosives shall not be taken underground at any time. Black blasting powder or pellet powder shall not be used with any other explosive in the same borehole.

10.8. BEFORE AND AFTER FIRING

- a. Before firing, sufficient warning shall be given to enable the people working in the area to get off the danger zone. The danger zone shall be suitable cordoned off and flag men posted at important points.
- b. No loose materials, such as tools, drilling implements etc. Shall be left on the rock surfaces to be blasted.
- c. Blasting in the open shall be carried out during the fixed hours every day or on fixed days in the week. This information shall be amply publicized and the following precautions observed:
- d. On the project sites, where blasting operations are carried out, daily blasting hours shall be clearly printed on the sign-boards on all the roads approaching that area.
 - i. Road closing barriers should be provided to close the traffic on these roads, at least 400 meters away when the firing is to take place.

- ii. The beginning of the firing shall follow loud sirens and similarly loud sirens shall succeed the completion of the firing.
- e. The shot-firer shall not be allowed to return to the blasting site after firing, until at least 5 min have elapsed. In case of electric shot firing, the shot holes shall be examined after firing and in case of misfire no person shall be allowed to approach the blasting site for at least 5 min. In case of shot firing with safety fuse, utmost care shall be taken to count the number to ensure that all the shots have fired and in the event of misfire, no person shall be allowed to approach the blasting site for at least 30 min. In any case, a careful inspection for the remaining un-detonated explosive shall be made after firing the shots. All misfired shot holes shall be cross-marked. No other person than those duly authorized shall approach the holes until one of the following operations has been performed in respect of each of the misfired holes:
 - f. If the misfire is due to a faulty cable or faulty electrical connection the defect shall be remedied and the shot fired.
 - g. The stemming shall be floated out by use of water or air jet from hose until the hole has been opened to within 60 cm of the charge, whereupon water will be siphoned or pumped out, then a fresh new charge placed and duly detonated. Or
 - i. A careful search shall be made of unexploded material in the debris of the charge.
 - ii. If a shift charge is unavoidable, the person in-charge of one shift before leaving the work shall inform the person relieving him for the next shift of any cases misfired and shall point out their position duly cross marked and also state clearly what action has to be taken in the matter.

Note: The rules are made considering statutory provisions and other National/International standards. However, if any statutory provision overruling these laws is made, the statutory provisions shall overrule the NTPC Rules.

11.0 SAFETY IN EXCAVATION & TUNNELING WORK

SAFETY IN EXCAVATION

11.1 GENERAL PROVISIONS

- a. Before undertaking any activity, the soil shall be tested and in case of availability of any explosive gas, necessary arrangements must be made to remove/dilute such gases and in case they are found to be toxic or poisonous, the workplace must be purged and continuous ventilation maintaining the contamination below the permissible level ensured;
- b. The position of underground installations such as sewers, water pipes and electrical cables shall be verified and in case of their existence, they must be isolated;
- c. If they cannot be isolated or removed or shutdown, they shall be fenced, hung up or otherwise protected. On every part likely to be visited by persons or where transport vehicles ply, the area shall be suitably fenced, guarded or barricaded to prevent fall of persons, vehicles or livestock into the excavated area;
- d. Warning signs shall be erected and the in the night hours the area shall be illuminated to warn pedestrians and vehicular traffic;
- e. Arrangements shall be made to prevent external vibrations due to rail/road traffic;
- f. Blasting shall be carried out in accordance with the norms applicable in this regard. Special care shall be taken to control the impact of vibrations/tremor caused by blasting to protect excavations from cave-ins;
- g. Arrangements shall be made to save other buildings/structures in the affected zone or in the vicinity of the area of excavation, from collapse;

11.2 SHORING AND TIMBERING

- a. Site of excavations, where workers are exposed to danger from moving ground, shall be made safe by maintaining due slope not exceeding the angle of repose of different types of soil or otherwise by shoring, portable shields or other effective means;
- b. All trenches in the soil, other than rock or hard compact soil more than 1.5 m deep into which men enter, shall be securely shored and timbered under the supervision of a competent person and only the trained workers shall be allowed to substantially alter or dismantle the shoring or timbering;
- c. All struts, braces and walls in excavation shall be adequately secured so as to prevent their accidental displacement;
- d. In all excavations in soft or fissured rock or hard soil exceeding 2 m in depth, except those which are sloped to within 1.5 m of the bottom into which men enter, shall be securely shored and timbered;
- e. Where the sides of the excavations are sloped as outlined above, but not within the 1.5 m of the bottom, vertical sides shall be shored and the shoring shall extend at least 30 cm above the vertical sides. When open spaced sheathing is used, a toe-board shall be provided to prevent material rolling down the slope and falling into the excavated.

11.3. SHEATHING

- a. The sheathing should be placed against the side of the trench so that length of each piece of sheathing is vertical. It should be held securely in place against the wales by ensuring that sheathing is kept firmly pressed against the wall of the trench. Where the trench excavated is loose, sandy or soft soil or soil which has been previously excavated or soil which is under hydrostatic pressure, each piece of sheathing shall be driven into the bottom of the trench so as to firmly hold it in place;
- b. Where two or more pieces of sheathing are used one above another, the sheathing shall be so arranged that the lower pieces of sheathing shall overlap the lowest wales supporting the piece of sheathing next above it. These pieces of sheathing shall be firmly driven into the soil and securely supported by wales and struts, as the trench is made deeper.

11.4. WALES

- a. The wales shall be parallel to the bottom or the proposed bottom of the trench. Each wale shall be supported on cleats spiked to the sheathing or by posts set on the wales next below it and in the case of the lowest wale on the bottom of the trench itself. Where necessary, wedges may be provided between a wale and the sheathing it supports so that roughly uniformity is given to all individual pieces of sheathing.

11.5. STRUTS

- a. Struts shall be horizontal and at right angles to the wales or sheathing supported thereby. Struts shall be cut to the proper length required to fit in tightly between the wales. Where necessary, the struts shall be held securely in place by wedges, driven between the struts and the wales;
- b. Struts shall be placed on cleats spiked or bolted to the posts supporting the Wales.

11.6. LOOSE SITE MATERIALS:

No loose material shall be kept very close to the excavation creating possibility of its fall into the excavated area. A safe distance of at least 1 m shall be maintained.

11.7. PLANT & MACHINERY:

Movement of vehicles and heavy equipment shall be kept at a distance least equal to the depth of the excavation or at least 6 m for excavation deeper than 6 m and the workers shall be provided with proper tools.

11.8. MEANS OF ACCESS

- a. For trenches deeper than 1.5 m, safe means of access and egress shall be provided at intervals of every 15 m. Where it is not possible to provide safe means of access and egress as above, ladders shall extend from the bottom of the trench to at least 90 cm above the ground;
- b. Walkways, runways and sidewalks shall be kept clear of excavated materials or other obstructions and no side walls shall be undermined-undercut unless it is capable of carrying a minimum live load of 125 lbs per square feet;

- c. If planks are used for raising walkways, runways or sidewalks, they should be parallel to the length of the walk and fastened together against displacement;
- d. Lone worker shall not be allowed to work in the excavated area.

11.9. INSPECTIONS:

A competent person shall make inspections every day and necessary measures shall be taken to safeguard against possible cave-ins or slide or collapse of the excavations.

11.10. NOTIFICATION OF INTENTION TO CARRY OUT EXCAVATION AND TUNNELING WORK

- a. Within thirty days, prior to the commencement of such excavation or tunneling work, the contractor shall inform in writing the detailed layout plans, method of construction and schedule of such excavation or tunneling work to the Engineer in-charge of NTPC;
- b. In case compressed air is used in such excavation or tunneling work or any work incidental to or required for such excavation or tunneling work, the technical details and drawings of all man-locks and medical-locks together with names and addresses of all construction medical officers duly qualified and so appointed by such contractor for the purpose of such excavation or tunneling work shall be sent to the Engineer in-charge.

11.11. PROJECT ENGINEER

- a. The contractor undertaking any excavation or tunneling work shall appoint a Project Engineer for safe operation of such projects;
- b. Such Project Engineer shall exercise overall control of the operations and the activities at such project and be responsible for carrying out the activities safely.

11.12. RESPONSIBLE PERSON

- a. The contractor undertaking excavation or tunneling work at construction site of a building or other construction work shall appoint a responsible person for safe operation of such excavation or tunneling work;
- b. The name and addresses of such responsible persons shall be forwarded to the Engineer in-charge;
- c. Duties and responsibilities of the responsible person referred to above person shall include
 - i. To carry out smoothly such excavation or tunneling work;
 - ii. To inspect and rectify any hazardous situation relating to such excavation or tunneling work;
 - iii. To take remedial measures to avoid any unsafe practice or conditions relating to such excavation or tunneling work.

11.13. WARNING SIGNS AND NOTICES

- a. Suitable warning signs or notices, required for the safety of building workers carrying out the work of an excavation or tunneling, shall be displayed or erected at conspicuous places in Hindi

and in language understood by the majority of such building workers at such excavation or tunneling work;

- b. Such warning signs and notices with regard to compressed air working shall include:
 - i) The danger involved in such compressed air work;
 - ii) Fire and explosion hazards;
 - iii) The emergency procedures for rescue from such danger or hazards.

11.14. REGISTER OF EMPLOYMENT

- a. The contractor shall ensure that at a construction site of a building or other construction work where an excavation or tunneling work is being carried on, a register of employment of building workers carrying out such excavation or tunneling work is maintained and produced on demand;
- b. Periods of work of such excavation or tunneling work shall be maintained in a register on day-to-day basis and such register shall be produced on demand

11.15. ILLUMINATION

- a. All contractors carrying out excavation or tunneling work at a construction site of a building or other construction work shall provide for emergency generators on such construction site to ensure adequate illumination at all work places where such excavation or tunneling work is being carried out;
- b. In case of power failure, all workplaces where excavation or tunneling works are carried out shall be adequately illuminated

11.16. PNEUMATIC TOOLS:

Supply lines to pneumatic tools used within a tunnel are fitted with water trap or safety chain or safety wire, as the case may be.

11.17. STABILITY OF STRUCTURE DURING GENERAL EXCAVATION & TUNNELING:

The contractor shall ensure that where there is any doubt as to the stability of any structure adjoining the workplace or other areas to be excavated or where tunneling work is to be carried out –

- a. The Project Engineer shall arrange for measures like underpinning, sheet piling, shoring, bracing or other similar means to support such structure and to prevent injury to any building worker working adjacent to such structure or damage to property or equipment adjacent to such structure;
- b. Where any building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than 1.5 m above his footing, such worker shall be protected by adequate piling and bracing against such bank or side;

- c. The excavation and its vicinity shall be checked by a responsible person after every rain, storm or other occurrences carrying hazards and in case a hazard is noticed at such checking, adequate protection against slides and cave-in to prevent such hazard shall be provided;
- d. Temporary sheet piling installed for the construction of a retaining wall after excavation shall not be removed, except on the advice of the responsible person after an inspection carried out by such responsible person;
- e. Where banks of an excavation are undercut, adequate shoring shall be provided to support the material or article overhanging such bank;
- f. Excavated material shall not be stored at least 0.5 m from the edge of an open excavation or trench and the banks of such excavation or trench shall be stripped of loose rocks and other materials which may slide, roll or fall upon a building worker working below such bank;
- g. Adequate and suitable warning signs shall be put-up at conspicuous places at the excavation work to avoid any person falling into the excavations or trenches;
- h. The responsible person shall ensure at the excavation that no building worker is permitted to work where such building worker may be struck or endangered by the excavation machinery or material or article used in such excavation.

11.18. SAFE ACCESS AND EGRESS:

Ladders, staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where the depth of such excavation exceeds one point 1.5 m and such ladders, staircases or ramps comply with the relevant national standards.

11.19. TRENCHES

- a. A trench or excavation shall be protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection shall be an improved protection in accordance with the design and drawing of a Professional Engineer, where such depth exceeds 4 m;
- b. Where the depth of a trench requires two lengths of sheet piling, one above the other, the lower piling shall be set inside the bottom strings or wales of the upper piling and such sheet piling shall be driven down and braced as the excavation continues;
- c. All metal sheet piles used in excavation or a trench shall be welded end-to-end and secured by other similar means.

11.20. POSITIONING AND USE OF MACHINERY:

Any machinery used in excavation and tunneling work shall be positioned and operated in such a way that such machinery will not endanger the operator of such machinery or any other person in the vicinity.

11.21. BREATHING APPARATUS:

Suitable breathing apparatus shall be provided to a building worker while working in compressed air environment for his use at excavation or tunneling work and such breathing apparatus shall be maintained in good working condition at all times.

11.22. SAFETY MEASURES FOR TUNNELING OPERATIONS

- a. Where there is a danger of falling or sliding of material from the roof face or wall of a tunnel, adequate measures such as shoring, supporting by means of rock bolts, segments or steel sets shall be taken for the safety of building workers;
- b. The excavated areas shall be made safe by use of suitably designed and installed steel sets, rock bolts or similar other safe means;
- c. The responsible person shall examine and inspect the workplaces in a tunnel before the commencement of work in such tunnel and at regular intervals thereafter to ensure safety of the building workers in such tunnel;
- d. The portal areas of a tunnel with loose soil or rock, likely to cause injury to a person shall be adequately protected with supports.

11.23. SURROUNDINGS OF A SHAFT

- a. Surroundings of a shaft used in excavation or tunnel work shall be protected from being washed away by construction of sufficient height;
- b. Where a building worker is required to enter a shaft at an excavation or tunneling work, safe means of access shall be provided for such entry;
- c. Every shaft at excavation or tunneling work shall be provided with a steel casing, concrete piping, timber shoring or other materials of adequate strength for the safety of building workers working in such shaft;
- d. Such casing and bracing shall be provided to shafts at an excavation or tunneling work according to the appropriate design for such casing and bracing;
- e. A reinforced concrete raft and beam shall be provided around the opening of a shaft at an excavation or tunneling work if the ground surrounding such opening is unstable or unsafe.

11.24. LIFT FOR SHAFT:

Lift shall be provided for transport of building workers and materials or articles at an excavation or tunneling work required to descend more than 50 m in a shaft.

11.25. MEANS OF COMMUNICATION

Reliable and effective means of communication such as telephone or walkie-talkie shall be provided and maintained in working order for arranging better and effective communication at an excavation or tunneling work at the following locations, namely:

- i. Working chamber of an excavation;
- ii. Intervals of hundred meters along the tunnel;
- iii. Working chamber side of a man lock near the door of such man lock;
- iv. Interior or each chamber of a man lock;
- v. Location conspicuous lock attendant's situation;
- vi. A compressor plant;

- vii. A first-aid station, and
- viii. Outside the portal or the top of a shaft;
- ix. Such number of bells and whistles shall be made available at all times at the locations as are necessary for the safety of persons at such locations.

11.26. SIGNALS:

The standard audio or video signals shall be used in excavation or tunneling work and conspicuously located or displayed near entrance to the workplace and in such other locations as may be necessary to bring such signals to notice of all building workers employed in such excavation or tunneling work.

11.27. CLEARANCES

- a. The minimum lateral clearances of 0.5 m shall be maintained between any part of a vehicle and any fixture or any equipment used in an excavation or tunneling work after allowing the throw or swing of such fixture or equipment;
- b. The overhead clearance for a locomotive drive at excavation or tunneling work shall not be less than 1.20 m above the seat of such driver and not less than 2 m above the platform where such driver stands or of any other dimension in accordance with the approved standard.

11.28. SHELTERS:

The adequate number of shelters for the safeguard of the building workers are provided where, in the course of working, they are liable to be struck by a moving vehicle or other material handling equipment in a tunnel.

11.29. USE OF INTERNAL COMBUSTION ENGINE:

No internal combustion engine shall be used underground in excavation or tunneling work unless such engine is so constructed that the air entering the engine gets cleared before entry and the engine emits no fumes or sparks.

11.30. INFLAMMABLE OILS:

Inflammable oils with the flash point below the working temperature that is likely to be encountered in a tunnel shall not be used in excavation or tunneling work.

11.31. COUPLING AND HOSES:

All high-pressure hydraulic hoses and couplings shall be adequately protected against any possible damage in excavation or tunneling work.

11.32. HOSE INSTALLATION:

All hydraulic lines and plants working at a temperature exceeding 750 c shall be protected by adequate insulation or otherwise against accidental human contact in excavation or tunneling work.

11.33. FIRE RESISTANT HOSES:

No fire hydraulic hoses other than fire resistant hydraulic hoses are used when hydraulically activated machinery and equipment are employed in tunnels.

11.34. FLAMEPROOF EQUIPMENT:

Only flameproof equipment of appropriate type as per approved standards shall be used where there is a danger of flammable or explosive atmosphere being prevalent inside the tunnel.

11.35. STORING OF OIL AND FUEL UNDERGROUND:

All oils, greases or fuels stored underground in excavation or tunneling work shall be kept in tightly sealed containers and in fire resistant areas at safe distances away from explosive and other flammable chemical and appropriate flameproof installation shall be used in such storage areas.

11.36. USE OF GASES UNDERGROUND

- a. Petrol or liquefied petroleum gas or any other flammable substances shall not be used or stored inside the tunnel except with the prior approval of the Project Engineer;
- b. After the use of the petroleum or liquefied petroleum gas, or highly inflammable substances, all remaining petroleum or liquefied petroleum gas or highly inflammable substances shall be removed immediately from such tunnel;
- c. No oxy-acetylene gas shall be used in a compressed air environment in excavation or tunneling work.

11.37. WATER FOR FIRE FIGHTING

- a. Adequate number of water outlets shall be provided on excavation or tunneling work and readily made accessible throughout the tunnel for fire fighting purposes and such water outlets shall be maintained for effective fire fighting;
- b. All air locks shall be equipped with fire fighting facilities at excavation or tunneling work;
- c. An audible fire alarm shall be provided to warn the building workers whenever a fire breaks out on an excavation or tunneling work;
- d. Adequate number and types of fire extinguishers, in accordance with relevant national standards, shall be provided and made readily available to fight any outbreak of fire at an excavation or tunneling work;
- e. Fire extinguishers with vaporizing liquids and high pressure carbon dioxide shall not be used in tunnels or other confined spaces;
- f. The instructions regarding steps to be followed to fight outbreak of fire, at an excavation or tunneling work, written in Hindi or local language understood by the majority of the building workers employed on such excavation or tunneling work, shall be displayed at conspicuous and vulnerable places of such excavation or tunneling work.

11.38. FLOODING

- a. Water tight bulkhead doors shall be installed at the entrance of a tunnel to prevent flooding during a tunneling work where more than one tunnel is driven from a shaft;
- b. All necessary measures shall be taken to ensure that no building worker is trapped in any isolated section of a tunnel when any bulkhead door of such tunnel is closed;
- c. Where there is likelihood of flooding or water rushing into a tunnel during a tunneling work, arrangements shall be made for immediate starting of water pumps to take out water of such flooding or water rushing and for giving alert signals to the building workers and other persons to keep them away from danger.
- d. Airtight steel curtains shall be provided in areas liable to flooding at tunneling work and in case of descending tunnels, such curtains shall be provided in the top half of such tunnels to ensure the retention of pockets of air for rescue purpose.

11.39. REST SHELTERS

- a. Where building workers employed in a compressed air environment in a tunneling work are required to remain at the work site for one hour or more after de-compression from pressure exceeding one bar, adequate and suitable facilities shall be provided for such building workers to rest;
 - a. Every man-lock, medical-lock and any other facility inside these locks in a tunneling work shall be maintained in a clean state and in good repairs;
 - b. A first-aid room shall be provided and readily available at a construction site of a tunneling work;
 - c. Each man-lock attendant at the station shall be provided with a first-aid box.

11.40. PERMISSIBLE LIMIT OF EXPOSURE OF CHEMICALS

- a. The working environment in a tunnel or a shaft in which building workers are employed shall not contain any of the hazardous substances in concentrations beyond the permissible limits;
- b. The responsible person referred to shall conduct necessary test before the commencement of a tunneling work for the day and at suitable intervals as fixed by the Engineer in-charge, to ensure that the permissible limits of exposure are not exceeded and a record of such test shall be maintained and made available for inspection.

11.41. VENTILATION:

All working areas in a free air tunnel shall be provided with the approved ventilation system and the fresh air supplied in such tunnel shall not be less than 6 m³ per minute for each building worker employed underground in such tunnel and the free air-flow movement inside such tunnel not less than 9 m³ per minute.

11.42. AIR SUPPLY INTAKE POINT:

The air intake points for all air compression shall be located at places where such intake air does not get contaminated with dust, fumes, vapor and exhaust gases or other contaminants.

11.43. EMERGENCY GENERATORS

- a. Every compressed air system in a tunnel shall be provided with emergency power supply system for maintaining continued supply of compressed air in such compressed air system, which shall be capable of operating air compressor and ancillary systems of such compressed air system;
- b. The emergency power supply system shall be maintained and made readily available at all times.

11.45. AIR MAINS:

Every air-main supplying air to the working chamber, man-lock or medical-lock used at an excavation or tunneling work shall be protected against accidental damage and where it is not practicable to provide such protection, a stand-by air-main shall be provided.

11.46. BULKHEAD AND AIR LOCKS

- a. A bulk head or air tight diaphragms retaining compressed air, when used within a tunnel or a shaft, shall be constructed to withstand the maximum pressure at 1.25 the maximum working pressure of such bulk head or diaphragm and such bulk head or diaphragm shall be tested before its each use by a responsible person to ensure that such bulk head or diaphragm is in proper working order;
- b. Such responsible person shall keep the record of each test and such record shall be produced for inspection.
- c. The bulk head or diaphragm shall be made of sound material of adequate strength, which shall be able to withstand the maximum pressure on which they are subjected to at any time of their use;
- d. A bulkhead anchorage and air lock shall be tested at its work place at an excavation or tunneling work immediately after their installation at such place.

11.47. DIAPHRAGM:

All diaphragms, which are in the form of horizontal decks across a shaft used at excavation or tunneling work, shall be securely anchored

11.48. PORTABLE ELECTRICAL HAND TOOLS:

All portable electrical hand tools and inspection lamps used underground or in a confined space shall be operated at a voltage not exceeding 24 V.

11.49. CIRCUIT BREAKER

- a. Adequate numbers of differential ground fault circuit breakers shall be installed for every electrical distribution system and its sub-systems used at an excavation or tunneling;
- b. Work and the sensitivity of each of circuit breaker shall be adjusted in accordance with the requirement set out in accordance with the approved standards;
- c. No semi-enclosed fuse unit shall be used in underground place.

11.50. TRANSFORMER:

The contractor shall ensure no transformer is used in any section of a tunnel under compressed air unless such transformer is of the dry type and conforms to the approved standards.

11.51. LIVE WIRES:

There shall be no exposed live wire in working areas at an excavation or tunneling work which are accessible to building workers other than those authorized to work on such live lines.

11.52. WELDING SETS:

All welding sets used in a tunnel shall be of adequate capacity and of suitable type, duly approved.

11.53. QUALITY AND QUANTITY

- a. Every working chamber at an excavation or tunneling work where compressed air is used, the supply of such air shall be maintained at not less than 0.3 m³ per minute per person working therein;
- b. A reserve supply of compressed air shall be made available at all times for man-locks and medical locks used at a tunneling work;
- c. The air supplied in a compressed air environment at a tunneling work shall be, as far as practicable, free from contaminants, namely, dust, fumes and other toxic substances.

11.54. WORKING TEMPERATURE:

The temperature in any working chamber at an excavation or tunneling work where building workers are employed shall not exceed 29^o c and the arrangement shall be maintained for kipping records in which the temperatures measured by dry bulb and wet bulb inside such working chamber once in every hour and for producing such records for inspection on demand.

11.55. MAN-LOCKS AND WORKING IN COMPRESSED AIR ENVIRONMENT

- a. Man-locks used at a tunneling work shall be of adequate strength, made of sound material and designed to withstand any pressure, internal or external, to which it may be subjected in the normal use or in an emergency;
- b. Doors of man-locks at an excavation or tunneling work shall be made of steel and used at a tunneling work for keeping the work airtight and devices shall be provided for sealing the doors when such locks are under pressure. The anchorage of a man-lock used at tunneling work shall have adequate strength to withstand the pressure exerted by air on the man-lock. There shall be adequate room available for the workers for working in the man-locks;
- c. Where work is carried out in any compressed air tunnel, a Man-lock in accordance with the approved standards shall be used;
- d. Where a man-lock is used, safety Instructions in Hindi and in local language understood by majority of building workers employed there, shall be displaced at conspicuous places;
- e. Except in an emergency, compression and de-compression operations shall be carried out in a man-lock and in an emergency any material-lock may be used;
- f. A record of compression and de-compression shall be kept in writing and produced for inspection on demand;
- g. Material lock shall be used with the permission of the Engineer in-charge where it is impracticable to install both the man-lock and the material-lock at;
- h. The man-lock at tunneling work shall not be used for any purpose

- i. other than compression or de-compression of building workers;
- j. No de-canting of building workers at tunneling work shall be carried
- k. out without prior approval of the Engineer in-charge except in an emergency;
- l. In case a building worker collapses or is taken ill during his de-compression in a man-lock, the lock attendant of such man-lock shall raise the pressure to a level equal to the maximum pressure which that building worker was exposed to in the working chamber prior to such de-compression and such lock attendant shall immediately report the matter relating to such collapse to the medical lock attendant and medical officer on duty;
- m. A building worker who had previously received training with a trained building worker to work in a compressed air environment at tunneling work shall be employed to work independently in such a compressed air environment;
- n. A building worker who had undergone three de-compressions from a pressure exceeding one bar in a period of eight hours at tunneling work shall not be allowed to enter a compressed air environment except for the purpose of carrying out rescue work;
- o. A building worker employed in a compressed air environment for a period of eight hours in a day at tunneling work shall not be employed again in such environment unless he has spent not less than twelve consecutive hours of rest at atmospheric pressure;
- p. No building worker shall be engaged in a compressed air environment at a pressure, which exceeds three bars at a tunneling work unless prior permission, in writing, has been obtained from the Engineer in-charge;
- q. No building worker shall be employed in a compressed air environment for more than fourteen consecutive days in a month;
- r. A register of employment of all building workers in compressed air environment shall be maintained;
- s. An identification badge shall be supplied to a building worker employed in compressed air environment;
- t. The badge of a building worker shall contain particulars of his name, location of the medical-lock allotted to him for work, the telephone number of the Construction Medical Officer concerned for his treatment and the instructions in case of his illness of unknown and doubtful causes;
- u. Record of all identification badges supplied to building shall be kept in a register;
- v. Every building worker whose name appears in the register shall wear the badge supplied to him at all times during his duty hours;
- w. Suitable warning signs shall be displayed in the compressed air for the prohibition of the following, namely:
 - i) Use of alcoholic drinks;
 - ii) Use and carrying of lighters, matches or other sources of ignition;
 - iii) Smoking; and

iv) No entry to person who has consumed alcoholic drink

11.56.SAFETY INSTRUCTION:

All building workers employed in compressed air environment at tunneling work shall follow the instructions issued for their safety in the course of such employment.

11.57.MEDICAL-LOCK

- a. A suitably constructed medical lock shall be maintained at tunneling work where building workers are employed in a working chamber at a pressure exceeding one bar;
- b. Where more than one hundred building workers are employed in a compressed air working environment exceeding one bar at tunneling work, one medical-lock is provided for every one hundred building workers or part thereof and such medical lock shall be situated as near as possible to the main-lock used at such tunneling work.

12.0. SAFETY IN PILING WORK

12.1. GENERAL PROVISIONS

- a. All pile driving equipment shall be of good design and sound construction, taking into account the ergonomic principles and properly maintained;
- b. A pile driver shall be firmly supported on a heavy timber sill, concrete bed or other secured foundation;
- c. In case a pile driver is required to be erected in dangerous proximity to an electrical conductor, all necessary precautions shall be taken to ensure safety;
- d. The hoses of steam and air hammer shall be securely lashed to such hammer so as to prevent them from whipping in case of connection or break;
- e. Adequate precaution shall be taken to prevent the pile driver from over turning and hammer from missing the pile;
- f. A responsible person for inspecting pile-driving equipment shall inspect such equipment before taking it into use and takes all appropriate measures as required for the safety of building workers before commencing piling work by such equipment;
- g. Where there is any question of stability of a structure for its adjoining areas to be piled, such structure shall be supported, where necessary, by underpinning, sheet piling, shoring, and bracing or by other means to ensure safety and stability of such structure and to prevent injury to any person.

12.2. PROTECTION OF OPERATOR:

The operator of every pile driving equipment shall be protected from falling objects, steam, cinders or water by substantially covering or otherwise or by other means.

12.3. INSTRUCTION TO AND SUPERVISION OF BUILDING WORKERS WORKING ON PILE-DRIVING EQUIPMENT:

Every building worker working on a pile driving equipment shall be given instructions regarding safe work procedure to be followed in piling operation and shall be supervised by a responsible person throughout such work.

12.4. ENTRY OF UNAUTHORIZED PERSON:

The contractor shall ensure at a construction site of a buildings or other construction work that all piling areas where pile-driving equipment is in use are effectively cordoned off to prevent entry of unauthorized persons.

12.5. INSPECTION AND MAINTENANCE OF PILE DRIVING EQUIPMENT

- a. Pile-driving equipment shall not be taken into use until it has been inspected by a responsible person and found to be safe for such use;
- b. A responsible person for such inspection at suitable intervals to ensure safety to the building worker working on such equipment shall inspect pile driving equipment in use;

- c. All pile lines and pulley blocks shall be inspected by a responsible person before the beginning of each shift of piling operations.

12.6. OPERATION OF PILE-DRIVING EQUIPMENT

- a. Only experienced and trained building worker shall operate pile driving so as to avoid any probable danger from such operation;
- b. Pile-driving operations shall be governed generally prevalent and accepted signals so as to prevent any probable danger from such operations;
- c. Every building worker employed in pile driving operation or in the vicinity of such pile driving operation shall wear ear protection and safety helmet or hardhat and safety shoes;
- d. Piles shall be prepared at a distance, at least equal to twice the length of the longest pile, from the place of pile-driving operations;
- e. When a pile driver is not in use, the hammer of such pile driver shall be blocked at the bottom of the heads of such pile driver.

12.7. WORKING PLATFORM ON PILING FRAMES:

Where a structural tower supports the lead of a pile driver, leads at which it is necessary for the building workers to work and such platforms except on the hammer of such pile driver or lead sides of such platform and where such platforms cannot be provided with such railing and toe boards, a safety belt shall be provided to each such building worker.

12.8. PILE TESTING

- a. The testing of pile shall be conducted under the supervision of a responsible person for such testing;
- b. All practicable measures like displaying of warning notices, barricading the area and other similar measures shall be taken to protect the area where the pile testing is carried out;
- c. Entry to a pile testing area shall be prohibited to general public to ensure safety.

12.9. PILING, SHORING AND BRACING

- a. Planks used for sheet piling in excavation or tunneling work shall be of sound material with adequate strength;
- b. Shores and braces used in excavation or tunneling work shall be of adequate dimensions and so placed as to be effective for their intended purposes;
- c. Earth supported shores or braces used in excavation or tunneling work shall bear against a footing of sufficient area and stability to prevent the shifting of such shores or braces.

13.0. SAFETY IN THE ERECTION, USE AND DISMANTLING OF SCAFFOLDS

13.1. SCAFFOLD CONSTRUCTION

- a. Every scaffold and every component thereof shall be of adequate construction, made of sound material and free from defects and safe for the purposes for which it is intended for use;
- b. In case bamboo is used for scaffolding, such bamboo shall be of suitable quality, good condition, free from protruding knots and stripped off to avoid any injury to building workers during handling such bamboo;
- c. All metal scaffolds used in building or other construction work shall conform to the approved standards;

13.2. SUPERVISION BY A RESPONSIBLE PERSON: No scaffold shall be erected, added, altered or dismantled except under the supervision of a responsible person.

13.3. Maintenance

- a. The scaffold used in building or other construction work shall be maintained in good repairs and the measures taken against its accidental displacement or any other hazard;
- b. No scaffold or part thereof shall be partly dismantled and allowed to remain in such a condition unless –
 - i) The stability or safety of the remaining portion of such scaffold has been ensured by a responsible person for the safety of such scaffolds;
 - ii) In case the remaining part of such scaffold cannot be used by the building workers, necessary warning notice written in Hindi and in a language understood by the majority of the building workers that such scaffold is unfit for use, shall be displayed at the place where such scaffold is erected.

13.4. STANDARDS, LEDGERS, PUTLOGS

- a. Standards of a scaffold shall be plumb, where practicable, fixed sufficiently close together to secure the stability of such scaffold having regard to all the possible working situations and conditions for the intended use of such scaffold, spaced, as close as practicable, to ensure safety and stability of such scaffold;
- b. Adequate measures are taken to, prevent displacement of a standard of a scaffold either by providing sole plate or a base plate, as necessary;
- c. Ledgers of metal scaffold are placed at vertical intervals with due regard to safety and stability of such scaffold;
- d. Bamboo ledgers are kept as nearly as possible and are placed and fastened to the standards of a scaffold with due regard to the stability of such scaffold.

13.5. WORKING PLATFORM

- a. Working platform shall be provided around the face or edge of a building adjoining at every upper most permanent floor of such building under construction and at any level where construction work of such building is carried out;
- b. A platform shall be designed to suit the number of building workers to be employed on each bay of a scaffold work on such platform and the materials or articles and tools to be carried with them in such bay;
- c. The safe working load and the number of building workers to be employed in each bay of a scaffold shall be displayed for the information of all the building workers employed at such construction site.

13.6. BOARD, PLANK AND DECKING

- a. Board, plank and decking used in the construction of a working platform shall be of uniform size and strength and shall be capable of supporting the load and number of building workers keeping in view the safety of such building workers;
- b. Metal decking, which forms part of a working platform, shall be provided with non-skid surface;
- c. No board or plank which forms the working platform shall be projected beyond its end support unless it is effectively prevented from tripping or lifting and board, plank or decking shall be fastened and secured;
- d. At any one time, not more than two working platforms per bay, shall be used to support building workers or materials or articles at such bay;
- e. Adequate measures shall be taken to prevent injury which may be caused by falling material and objects by using safety nets or other suitable means;
- f. Concrete, other debris or materials shall not be allowed to accumulate at any platform on a scaffold;
- g. Where a work is to be done at the end of a wall, working platform at such workplace shall be faced or, wherever practicable, at least 0.6 m beyond the end of such wall.

13.7. REPAIR OF DAMAGED SCAFFOLD

- a. No building worker shall be permitted to work on a scaffold that has been damaged or weakened unless adequate safety measures have been taken to ensure the safety of such building worker;
- b. Necessary warning signs shall be displayed at such places where repairs of scaffold are undertaken.

13.8. OPENING

- a. There shall be no opening in any working platform except for allowing access to such working platform;
- b. Wherever opening on a platform is unavoidable, necessary measures for protection against falling of objects or building workers from such platform shall be taken by providing suitable safety nets, belts or any other similar means;
- c. Access from one working platform to another platform on a scaffold, if required, shall be provided with suitable and safe ladder for the use of building workers working on such platforms;

- d. Every opening or shaft in the floor shall be provided with suitable means to protect the fall of a person or material by providing suitable fencing or railing of height not less than 900 mm.

13.9. GUARDRAILS: Every side of a working platform from which a person is liable to fall shall be provided with suitable and safe guardrails and toe board of adequate strength to prevent fall of any building worker, material or tools from such platform.

13.10. SCAFFOLD USED BY BUILDING WORKERS OF DIFFERENT EMPLOYERS

- a. Where a scaffold or a part of a scaffold is used, which has previously been used by another employer for his building workers, such scaffold or part thereof shall be used only after its inspection and examination by a responsible person for ensuring that such scaffold or part thereof is safe and fit for such use;
- b. If any rectification, alteration or modification in a scaffold or part thereof, needed to suit its use, shall be made in consultation with the responsible person.

13.11. PROTECTION AGAINST ELECTRIC POWER LINE:

The contractor shall ensure that all necessary and practical measures for protection are taken to prevent any building worker, working on a scaffold, from coming into contact with the electric wires or dangerous equipment.

13.12. SCREENING NET AND WIRE NETS:

Where a scaffold is erected in an area where the construction activities may pose hazards to pedestrians or vehicular traffic nearby from the falling of objects, wire nets or screening nets shall be used to envelope such scaffold.

13.13. TOWER SCAFFOLD

- a. The height of every tower scaffold used in building or other construction work shall not be more than eight times the lesser to the base dimension of such scaffold;
- b. A tower scaffold shall be lashed to a building or a fixed structure before being used by the building workers;
- c. Any tower scaffold which can be moved or castered shall be –
 - i) Constructed with due regard to the stability and, if necessary, adequately weighted at the base;
 - ii) Used only on plain and even surface; and
 - iii) Has casters provided with positive locking devices to hold such scaffold in position;
- d. No building worker shall remain on board scaffold or leave behind tools and material when it is being shifted from one position to another position.

13.14. GEAR FOR SUSPENSION OF SCAFFOLD

- a. Chains, ropes or lifting gears used for suspension of a scaffold shall be of adequate strength, made of sound material and suitable for the purpose of their use and maintained in good repairs;
- b. Chains, wires, ropes or metal tubes used for the suspension of a scaffold shall be:

- i) Properly and securely fastened to every anchorage point and to the scaffold ledgers of other main supporting members used for the support of such scaffold; and
- ii) So positioned as to ensure stability of the scaffold.

13.15. TRESTLE SCAFFOLD AND CANTILEVER SCAFFOLD

- a. No trestle scaffold shall be constructed with more than three tiers or if its working platform is more than 4.5 m above the ground or floor or other surface upon which such scaffold is erected;
- b. Trestle scaffold shall be designed by professional engineer and shall have the approval of the Engineer in-charge before being taken into use.
- c. No trestle scaffold shall be erected on a suspended scaffold;
- d. No cantilever or jib scaffold shall be used unless it is adequately supported, fixed and anchored on opposite side of its support and have out triggers of adequate length and, where necessary sufficiently, supported and braced to ensure safety and stability of such scaffold;
- e. No working platform resting on bearers let into a wall at one end and without other support shall be used unless such bearers are of adequate strength, braced through the wall and securely fastened on the other side.

13.16. SCAFFOLD SUPPORTED BY BUILDING

- a. No part of a building shall be used as support or part of a scaffold unless such part of the building is made of sufficient strength and made of sound material to afford safe support;
- b. Overhanging eaves gutters shall not be used for supporting scaffold;
- c. Suspended scaffold shall be made of in accordance with the approved standards before being used by the building workers.

13.17. USE OF WINCHES AND CLIMBERS FOR SUSPENDED SCAFFOLD

- a. No scaffold shall be raised or lowered by winches or climbers unless such scaffold is made of sound material, adequate strength and has been tested and certified safe for use of winches or climber by a competent person before being taken into use;
- b. All suspended scaffolds counter-balanced by counter weights shall be of approved types before being taken into use for building or other construction work;
- c. The working platform of a suspended scaffold shall be securely fastened to the building or structure as to be safe and to prevent such platform from swing;
- d. The safe working load that a suspended scaffold can carry, shall be displayed where such scaffold is being used

13.18. SAFETY DEVICES FOR SUSPENDED SCAFFOLD

- a. Every suspended scaffold, raised or lowered by the winches or climbers, shall be provided at each of its suspension point with a safety rope with automatic safety device mounted on each of such rope so that such safety rope with such automatic safety device support the platform of such

scaffold in the event of failure of the primary suspension wire ropes, winches, climbers or any part of the mechanism used for raising or lowering such suspended scaffold;

b. Provided that the clause (a) shall not apply -

- i) Where the platform of such scaffold is supported at two independent suspension wire rope at or near each end of such platform so that in the event of failure of one of such suspension wire rope, the other wire rope is capable of sustaining the weights of such platform and its load and prevent it from tilting; or
- ii) Where a system is incorporated which operates automatically to support the platform of such scaffold and its load in the event of failure of the primary suspension wire rope of such scaffold.

14.0. SAFETY IN THE ERECTION OF STRUCTURAL FRAME & FORMWORK

14.1. GENERAL PROVISION

- a. The trained building worker under the direct supervision of a person, responsible for structural frame and formwork, shall be employed for erection of such structural frame or formwork, dismantling of building and structure and performance of and engineering work formwork, false work and shoring work;
- b. Adequate measures shall be taken to guard against hazards arising from any temporary state of weakness or unsuitability of a structure.

14.2. FORMWORK, FALSE WORK AND SHORING

- a. Formwork and false work shall be so designed, constructed and maintained that such formwork and false work are able to support the load that may be imposed on them;
- b. Such formwork shall be so erected that working platform, means of access, bracings, means of handling and stabilizing could easily be fixed with such formwork.

14.3. ERECTION OR DISMANTLING OF STEEL AND PREFABRICATED

- a. Erection or dismantling of any pre-fabricated structure shall be made safe against danger by using appropriate means such as ladders, gangways or fixed platforms, buckets, boatswains chair or other appropriate means suspended from lifting appliances, safety harness, life lines, catch nets or catch platforms, power-operated mobile working platforms etc.;
- b. The work of erection or dismantling of buildings or structures or formwork or false work or shoring or any other civil engineering work shall be carried out by trained building workers under the supervision of a person responsible for such work;
- c. Steel or prefabricated structures shall be so designed and made that such structures can be safely transported or erected; and weight of each unit of such structures shall be clearly marked on such unit;
- d. The design of each such part shall maintain stability of each part of the structures referred to in clauses above when erected, and to prevent danger, the design shall explicitly take into account –
 - i) The relevant conditions and methods of attachment in the operations of stripping, transport, storing and temporary support during erection of such parts;
 - ii) Safeguards, such as provision of railings with working platforms, and for mounting such railings and platforms easily on the structural steel or prefabricated parts;
- e. The hooks and softer devices built in or provided on the structural steel or prefabricate parts that are required for lifting and transporting such parts shall be so shaped, dimensioned and positioned to withstand the stresses to which such hooks or other devices are subjected;

- f. Prefabricated parts made of concrete shall not be stripped or erected before such concrete has set and hardened sufficiently to the extent provided for in the plans, and such parts are examined by the responsible person for any sign of damage before their use;
- g. Store-places shall be so constructed that –
 - i) There shall be no risk of structural steel or prefabricated parts falling or overturning;
 - ii) Storage conditions shall generally ensure stability and avoid damage having regard to the method of storage and atmospheric conditions; and
 - iii) Racks shall be set on firm ground and designed so that units cannot move accidentally in such store-places;
- h. Structural steel or pre-fabricated parts shall not be subjected to stresses prejudicial to their stability while they are stored or transported or raised or set down;
- i. Tongs, clamps and other appliances for lifting structural steel and prefabricated part shall be:
 - i) In such shape and dimensions as to ensure a secure grip without damaging and marked with the maximum permissible load in the most unfavourable lifting conditions; and
 - ii) Structural steel or pre-fabricated parts shall be lifted by such methods and appliances that prevent them from spinning accidentally;
- j. Structural steel or pre-fabricated parts shall be provided with railings and working platforms before raising such parts to prevent any danger of falling of building workers, materials or articles at the time of any work with such parts;
- k. All reasonably practical measures shall be taken to avoid injury to building workers, building structure or equipment while structural steel or pre-fabricated parts are handled or stored or transported or raised or lowered;
- l. Structures shall not be worked on during violent storms or high winds or any other such hazardous situation;
- m. The risk of falling to which building workers, moving on high or sloping girders, may be exposed is limited by all means of adequate collective protection or by the use of a safety harness which shall be well secured to a sufficiently strong supports;
- n. Structural steel parts, which are to be erected at a great height, shall, as far as practicable, be assembled on the ground;
- o. When structural steel or pre-fabricated parts are being erected, a sufficiently extended area underneath the workplace shall be barricaded or guarded;
- p. Steel trusses, which are being erected, shall be adequately shored, braced or guyed until they are permanently secured in position;
- q. Structural members shall not be forced into place by the hoisting machine while any building worker is in such a position that he is likely to be injured by such operation.

14.4. FORMWORK

- a. All formwork shall be properly designed keeping in view the safety of building workers, buildings or structures;
- b. A responsible person for structural frame and formwork shall –
 - i. Inspect and examine the material, timber, structural steel and scaffolding for its strength and suitability before being taken into use;
 - ii. Lay-down procedures to cover all stages of such structural frame and formwork;
 - iii. Supervise such structural frame and formwork;
 - iv. Take all necessary steps or measure to correct any situation with a view to prevent accident or dangerous occurrence during performances of such structural frame and formwork.

14.5. DE-SHORING

- a. When shoring is removed, sufficient props shall be left in place of such shoring to prevent any possible hazard; and
- b. Deshoring shall be adequately braced and tied together with support to prevent any hazard.

15.0. SAFETY IN CONCRETE WORK

15.1. GENERAL PROVISIONS REGARDING USE OF CONCRETE

- a. All construction with the use of concrete or reinforced concrete shall be based on plans including specification of steel and concrete and other material to be used in such construction –
 - i. Giving technical details regarding methods for safe placing and handing of such materials and indicating the type, quality and arrangement of each part of a structure of such construction; and
 - ii. Explaining the sequence of steps to be taken for completion of such construction;
- b. Formwork and shores used for concrete work shall be structurally safe and properly braced or tied together so as to maintain position and shape of formwork or shores;
- c. Formwork structure used shall have sufficient catwalks and other secure access for inspection of such structure if such structure is in two or more tiers;
- d. No machinery or any object should fall below by using wire nets, screen nets etc.

15.2. PREPARATION AND POURING OF CONCRETE AND ERECTION OF CONCRETE STRUCTURE

- a. A building worker handling cement or concrete shall –
 - i) Wear close-fitting clothing, gloves, helmet or hardhat, safety goggles, proper footwear and respirator or mask to protect himself from danger in such handling;
 - ii) Keep as much of his body covered as is required to protect himself from danger in such handling;
 - iii) Take all necessary precautions to keep cement and concrete away from his skin in such handling;
- b. Lime pits shall be fenced or enclosed and filled and emptied by such devices, which do not require workers to go into the pit;
- c. Moving parts of the elevators, hoists screens bunkers, chutes, grouting equipment used for concrete work and of other equipment used for storing, transport and other handling ingredients of concrete shall be securely fenced to avoid contact of building workers with such moving parts;
- d. Screw conveyors used for cement, lime and other dusty materials shall be completely enclosed.

15.3. BUCKETS

- a. Concrete buckets used with cranes or aerial cableways shall be free from projections from which accumulations of concrete could fall;
- b. Movements of concrete buckets shall be governed by signals necessary to avoid any danger by such movements.

15.4. PIPES AND PUMPS

- a. A scaffolding carrying a pipe for pumped concrete shall be strong enough to support such pipe at a time when such pipe is filled with concrete or water or any other liquid and carry the combined load of the all the building workers who may be on such scaffold at such time, safely;
- b. Every pipe for carrying pumped concrete shall be –
 - i) Securely anchored at its end point and at each curve on it;
 - ii) Provided near the top of such pipe with an air release valve;
 - iii) Securely attached to a pump nozzle by a bolted collar or other adequate means;
- c. The operation of concrete pumps shall be governed by standard signals;
- d. Building workers employed around a concrete pump shall wear safety goggles;

15.5. MIXING AND POURING OF CONCRETE

- a. The concrete mixture shall not contain any material, which may unduly affect the setting of such concrete, weaken such concrete or corrode steel used with such concrete;
- b. When dry ingredients of concrete are being mixed in confined spaces such as silos –
 - i) The dust shall be exhausted at the time of such mixing and
 - ii) In case the dust the dust cannot be exhausted, as specified, the workers shall wear respirators at the time of such mixing;
- c. When concrete is being tipped from buckets, building workers shall be kept out of the range of any kickbacks of such buckets;
- d. Loads shall not be dumped or placed on settling concrete.

15.6. CONCRETE PANELS AND SLABS

- a. All parts of a concrete panel or concrete slab shall be hoisted uniformly;
- b. Concrete panels shall be adequately braced in their final positions and such bracings shall remain in such positions until such panels are adequately supported by other parts of the construction for which such panels are used;
- c. Temporary bracings of concrete panels shall be securely fastened to prevent any part of such panels from falling when such panels are being moved.

15.7. STRESSED AND TENSIONED ELEMENTS

- a. Building workers shall not stand directly over jacking equipment while stressing of concrete girders and beams is being done;
- b. A pre – stressed concrete unit shall not be handled except at points on such unit and by the devices specified for such work by the manufacture of such devices;
- c. During transport, pre-stressed concrete girders or concrete beams shall be kept upright by bracing or other effective means;

- d. Anchor fittings for pre-tensioned strands of pre-stressed concrete girders of concert beams are kept in a safe condition in accordance with the instruction of manufacturer of such anchor fittings;
- e. Building workers shall not stand behind jacks or in line with tensioning elements and jacking equipment during tensioning operations of pre-stressed concrete girders of concrete beams;
- f. Building workers do not cut wires of pre – stressed concrete girders or concrete beams under tension before such concrete used of such girder or beams is sufficiently hardened.

15.8. VIBRATORS

- a. A building worker, who is in good physical condition, shall operate vibrators used in concreting work;
- b. All practical measures shall be taken to reduce the amount of vibration transmitted to the operators working in concreting work and
- c. When electric vibrators are used in concreting work
 - i) Such vibrators shall be earthed;
 - ii) The leads of such vibrators shall be heavily insulated; and
 - iii) The current shall be switched off when such vibrators are not in use.

15.9. INSPECTION AND SUPERVISION

- a. A person responsible for a concreting work shall supervise the erection of the formwork, shores, braces and other supports used for such concreting work, make a through inspection of every formwork to ensure that such formwork is safe, regularly inspect the formwork, shores, braces, reshores and other supports during the placing of concrete, keep all records of inspections referred to above at the workplace relating to such inspection and produce them for inspection upon the demand.
- b. Any unsafe condition, which is discovered during the inspections, shall be remedied immediately.

15.10. BEAMS, FLOORS AND ROOFS

- a. Horizontal and diagonal bracings shall be provided in both longitudinal and transverse direction as may be necessary to provide structural stability to formwork used in concreting work and shores used in such concreting work shall be properly seated on top and bottom and secured in their places;
- b. Where shores used in concreting work rest upon the ground, base plates shall be provided for keeping such shores firm and in level;
- c. Where the floor to ceiling height of a concreting work exceeds 9 m or where the formwork deck used in such concreting work is supported by shores constructed in two or more tiers, or where the dead, live and impact loads on the formwork used in such concreting work exceed 700 kilogram per m², the structure of such formwork shall be designed by a professional engineer in the relevant field and the specifications and drawings of such formwork kept at such construction site and produced on demand.

- d. Where a professional engineer designs the structure of the formwork used in concreting work, such engineer shall be responsible for the supervision of construction and the stability of such structure.

15.11. STRIPPING

- a. Stripping of formwork used in concreting work shall not commence until the concrete on such formwork is fully set, examined and certified to this effect by the responsible person and record of such examination and certification is maintained;
- b. Stripped forms in concreting work shall be removed or stock piled promptly after stripping from all areas in which building workers are required to work or pass;
- c. Protruding nail, wire ties and other formwork accessories not required for subsequent concreting work shall be pulled, cut or otherwise made safe.

15.12. RE-SHORING

- a. Re-shoring used in concreting work shall be provided to a slab or beam for its safe support after its stripping or where such slab or beam is subjected to superimposed loads due to construction above such slab or beam;
- b. The provisions applicable to shoring in a concreting work shall also be applicable to reshoring in such work or pass.

16.0. SAFETY IN CONSTRUCTION, REPAIR & MAINTENANCE OF STEEP ROOFS

16.1. WORK ON STEEP ROOFS:

All practicable measures shall be provided to protect the building workers against sliding when carrying outwork on steep roofs.

16.2. CONSTRUCTION AND INSTALLATION OF ROOFING BRACKETS

- a. Roofing brackets shall be constructed to fit the pitch of steep roof and such brackets shall be used to provide level working platform;
- b. Roofing bracket shall be secured in its place by nailing pointed metal projections attached to the underside of such bracket and securely driven into a steep roof on which it is used or secured by a rope passed over the ridgepole and tie of such roof.

16.3. CRAWLING BOARDS

- a. All crawling boards used for work on steep roofs shall be of adequate strength, made of sound material and of the type approved for the purpose of their use;
- b. Crawling boards shall be kept in good repairs and inspected by a responsible person before being taken into use;
- c. Crawling boards shall be secured to a steep roof on which it is used by ridge hooks or other effective means;
- d. A firmly fastened lifeline of adequate strength shall be strung beside each crawling board throughout its length while using such crawling boards.

17.0. SAFETY IN CATCHES PLATFORMS, HOARDINGS & CHUTES

17.1. CATCH PLATFORM

- a. Catch platform shall not be used for storage of material or as a working platform;
- b. Catch platform shall at least be of 2 m wide and inclined so that the position of outer edge of such platform is 1500 mm higher than the inner edge;
- c. The open end of catch platform shall be properly fenced to the height not less than 1 m.

17.2. HOARDINGS:

Hoardings shall be constructed when the Registering Authority / Assistant Labour Commissioner considers it necessary for protection of building workers and directs such employer to construct such hoardings.

17.3. CHUTES, ITS CONSTRUCTION AND USE

- a. Wooden or metal chutes which are at an angle of more than 45⁰ to the horizontal and used for the removal of materials shall be closed on all sides except at their openings used for receiving or discharging of materials or articles;
- b. All openings of chutes except their top openings shall be closed when not in use;
- c. Every chute –
 - i. Shall be constructed of sound material, adequate strength and suitable for the purpose it is intended for use;
 - ii. Exceeding 12 m in height shall be constructed in accordance with the design and drawings of professional engineer for such;
 - iii. A suitable warning notice shall be displayed at conspicuous locations, written in Hindi and in a local language, at the discharge end of every chute;
 - iv. Shall be cleared when debris has accumulated to a height, which can pose danger to building worker, but such clearance shall be done in no case less frequently than once a day.

18.0. SAFETY IN WORK ON OR ADJACENT TO WATER

18.1. TRANSPORT OF WORKERS BY WATER

- a. When any building worker has to proceed to or from any workplace by water for purposes of carrying on a building or other construction work, proper measures shall be taken to provide for his safe transportation and vessels used for such purpose shall be in charge of a responsible person, properly equipped for safe navigation and maintained in good condition;
- b. Maximum number of persons which can be safely carried in a vessel shall be marked plainly and conspicuously on such vessel and such number shall not be exceeded during use of such vessel for carrying persons;
- c. Adequate protecting shall be provided to the building workers in such vessel from inclement weather;
- d. Such vessel shall be manned by adequate and experienced crew;
- e. In case the bulwarks of such vessel are lower than 60 cm from the level of the deck of such vessel, the open edge of such bulwarks shall be fitted with suitable fencing to a height of at least 1 m above such deck and the post and stanchions and similar parts used in such fencing shall not be spaced more than 2 m;
- f. The number of life buoys on deck of such vessel shall at least be equal to the number of crew members of such vessel and shall not be less than two;
- g. All life buoys on deck of such vessel shall be kept in good state of maintenance and so placed that if such vessel sinks then they will remain afloat and one of such buoys shall be within the immediate reach of the Steersman of such vessel and another is situated after part of such vessel; and
- h. The position of the steersman of the vessel shall be such that he has a reasonably free view of all sides.

18.2. PREVENTION FROM DROWNING

- a. Where, on or adjacent to the workplace of any contraction site, there is water into which a building worker employed for work on such site, in the course of his employment, may fall and has the risk of drowning, suitable rescue equipment shall be provided and kept in an efficient state of ready use and measures shall be taken to arrange for the prompt rescue of such building worker from the danger of drowning and where there is a special risk of such fall from the edge of adjacent land or from a structure adjacent to or above the water, or from floating stage on such water, secure fencing shall be provided near the edge of such land, structure or floating stage, as the case may be, to prevent such fall, and such fencing may be removed or allowed to remain unerected for the time and to the extent necessary for the access of building workers to such work or the movement of material for such work;
- b. For handling rescue equipment, at least two persons knowing diving should be available at such sites.

19.0 SAFETY IN COFFERDAMS & CAISSONS

19.1 EVERY COFFERDAM AND CAISSON SHALL BE

- 19.1.1 Of good construction, sound material and of adequate strength, provided with adequate means for workers to reach safely at the top of such cofferdam or caisson in the event of an inrush of water and safe means of access to every place where workers shall be employed;
- 19.1.2 Work relating to construction, positioning, modification, dismantling of cofferdams or caissons shall be carried out under the supervision of a responsible person and inspected by the responsible person at the specified intervals;
- 19.1.3 A worker shall be allowed to work in a cofferdam or caisson after such cofferdam or caisson has been inspected and found safe by responsible person within such preceding period as approved and a record of such inspection maintained.

19.2 WORK IN COMPRESSED AIR IN A COFFERDAM OR CAISSON SHALL BE

- 19.2.1 Carried out in accordance with the procedure laid down;
- 19.2.2 Carried out by such building workers who have completed eighteen years of age and are medically examined and found fit for the work;
- 19.2.3 Carried out under the supervision of a responsible person;
- 19.2.4 If the work in cofferdam or caisson is carried out in shifts, a record of the time spent by each worker in each such shift for carrying out the work shall be maintained in a register with particulars or time taken for the compression of such building worker, if any;
- 19.2.5 At every work site or project in a cofferdam or caisson, where workers are employed to work in compressed air environment, a construction medical officer assisted by a nurse or trained first-aid attendant, shall be available at all times and there shall be one standby reserve compressor to meet the emergency.

19.3 PRESSURE PLANT AND EQUIPMENT

- 19.3.1 Pressure plant and equipment for which it is used shall be –
- 19.3.2 Properly maintained in good repairs and working condition and fitted with a suitable safety valve or other effective device to provide maximum safe discharge pressure from being exceeded at any time; a suitable pressure gauge with a dial range not less than 1.5 times and not exceeding twice the maximum working pressure, easily visible and designed to show at all times, the internal pressure in kilogram per square centimeter and marked with the maximum safe working pressure, a suitable stop valve or valves by which the pressure plant or the system of the pressure plant may be isolated from the source supply of pressure or otherwise;
- 19.3.3 Every pressure plant or equipment shall be thoroughly examined by the competent person, externally, once in every period of six months; internally, once in every period of twelve months; and by hydraulic test, once in a period of four years.

20. SAFETY IN DEMOLITION WORK

20.1 PREPARATION

- 20.1.1 All glass or similar material or article in exterior openings shall be removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines put off and suitably capped and the concerned department of the appropriate authority informed and permission obtained wherever required before commencing;
- 20.1.2 Wherever it is necessary to maintain water, gas or electric line or power during such demolition, such line shall be so located or protected with substantial coverings so as to protect it from damage and to afford safety to the building workers and the general public.

20.2 PROTECTION OF ADJACENT STRUCTURES

20.2.1 Examination of walls etc. of adjacent structures –

- i) During demolition process, the contractor shall examine the walls of all structures adjacent to the structure to be demolished to determine the thickness, method of support to such adjacent structures and;
- ii) In case, such employer has reason to believe that any of such adjacent structure is unsafe or may become unsafe during such demolition process, he shall not perform demolition activity unless stability to such unsafe adjacent structure from collapsing has been taken. All roads and open spaces adjacent to the site of demolition work shall be closed or suitably protected by bracketing.

20.3 DEMOLITION OF WALLS, PARTITIONS, ETC.

- 20.3.1 Any demolition of walls or partitions shall be proceeded in a systematic manner as per the standard safe operating practices approved and all work above each tier of any floor beams shall be completed before the safety of the supports of such beam is impaired;
- 20.3.2 Masonry shall be neither loosened nor permitted to fall in such masses or volume or weight as to endanger the structural stability of any floor or structural supports;
- 20.3.3 No wall chimney or other structure or part of a structure shall be left unguarded in such a condition that it may fall, collapse or weaken due to wind pressure or vibration;
- 20.3.4 In the case of demolition of exterior walls by hand, safe footing shall be provided for the workers employed in, such walls or partitions, which are to be demolished by hand shall be not left standing more than one storey high above the uppermost floor on which persons are working.

20.4 **METHOD OF OPERATION:** The contractor shall ensure that debris, bricks and other materials or articles are removed by means of chutes, buckets or hoists and through openings in the floors.

20.5 ACCESS TO FLOOR

- 20.5.1 Safe access to and egress from every building shall be provided at all times in the course of demolition by means of entrances hallways, stairways or ladder runs which shall be so protected as to safeguard the workers using such means from falling material or articles;

- 20.5.2 Demolition of structural steel etc. shall be demolished column by column and tier by tier and every structural member, which is being demolished, shall not be under any stress, and such structural member shall be suitably lashed to prevent it from any uncontrolled swinging, dropping or falling or falling;
- 20.5.3 Large structural members shall not be thrown or dropped from the building, but carefully lowered by adopting suitable safe method;
- 20.5.4 Where a lifting appliance like a derrick is used for demolition, the floor on which such lifting appliance rests shall be completely planked over or supported and such floor shall be of adequate strength to sustain bearing load for such lifting appliance and its operation.

20.6 STORAGE OF MATERIAL OR ARTICLE

- 20.6.1 No materials or articles shall be not stored or kept on platform, floor or stairways of a building being demolished, provided that this clause shall not apply to the floor of a building when such floor is of such strength as to support safely the load to be superimposed by storing such material or articles;
- 20.6.2 No access to any stairway or passageway shall be affected or blocked by storing any material or article;
- 20.6.3 Suitable barricades shall be provided so as to prevent materials or articles from sliding or rebounding into any space used by the workers.

20.7 FLOOR OPENINGS:

Every opening used for the removal of debris from every floor which is not closed to access, except the top or working floor, shall be provided with an enclosure from such floor to its ceiling, or such opening is so barricaded that no building worker shall access to within a horizontal distance of 6.0 m from such opening through which debris is being dropped.

20.8 INSPECTION:

A person responsible for demolition work shall make continuous inspections during demolition process so as to detect any hazard resulting from weakened or deteriorated floors or walls or loosened materials or articles, and that no building worker shall be permitted to work where such hazard exist unless remedial measured like shoring or bracing shall be taken to prevent such hazards.

20.9 WARNING SIGNS, BARRICADES, ETC.

- 20.9.1 Barricades and warning sign shall be erected along every side throughout the length and breadth of a building or other construction work to be demolished to prevent unauthorized persons from entering into the during demolition operations;
- 20.9.2 During the demolition of an exterior masonry wall or a roof from a point more than 12 m above the adjoining ground level of such wall or roof, if persons below such wall or roof are exposed to falling objects, suitable and safe catch platform shall be provided and maintained at a level not more than 6 m below the working level except where an exterior built-up scaffold is provided for safe and adequate protection of such persons;
- 20.9.3 Suitable and standard warning signs shall be displayed or erected at conspicuous places or position at the workplace;

20.10 MECHANICAL METHOD OF DEMOLITION

20.10.1 The following requirements shall be fulfilled in case the mechanical method of demolition like use of swinging weight, clamshell bucket, power shovel, bulldozer or other similar mechanical methods are used for the purpose of demolition namely –

- i) The building or structure or structure or remaining portion thereof shall be not more than 12 m in height;
- ii) Where a swinging weight is used for demolition, a zone of such demolition having a radius of at least 1.5 times the height of the structure of portion thereof being demolished shall be maintained around the points of impact of such swinging weight;
- iii) Where a clamshell bucket is being used for demolition, a zone of demolition shall be maintained within eight metres of the liner of travel of such bucket;
- iv) Where other mechanical methods are being used to affect total or partial collapse of a building or other construction work, there shall be maintained, in the area into which the affected portion of such building or other construction work may fall, a zone of demolition at least 1.5 times the height of such affected portion thereof; and
- v) No person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition, which shall be provided with substantial barricades.

21. FIRE EXTINGUISHERS & OTHER APPLIANCES OF FIRE FIGHTING

21.1 FIRE EXTINGUISHERS & OTHER MEANS OF PREVENTION AND PROTECTION

21.1.1 Every contractor shall have a fire protection and prevention plan developed and implemented keeping in view the following:

- i) The specific work practices requiring fire control measures;
- ii) Response measures to be taken in case of fire;
- iii) Equipment required;
- iv) Personnel requirements and responsibilities;
- v) Schedules of daily and weekly inspection;
- vi) Open flames and fires are prohibited in all underground construction;
- vii) Readily visible signs to be posted in the fire prone/inflammable/explosive areas prohibiting smoking use of open flames and other hot work.
- viii) A system of Permit-to-Work.

27.1.2 For the protection of the workers from the outbreak of fire, the contractor shall Provide, maintain and regularly inspect the Fire extinguishing equipment, which shall be sufficiently provided to extinguish any probable fire;

Suitability of portable fire extinguishers			
Class of fire	Type of extinguisher		
	Water	DCP	CO₂
A	Yes	Yes	Yes
B	No	Yes	Yes
C	No	Yes	Yes
D	No	Yes	Yes
Electrical	No	Yes	Yes

27.1.3 Ensure availability of an adequate supply of water at ample pressure;

27.1.4 Make available

- i. Adequate number of trained persons required to operate the fire extinguishing equipment;

- ii. Properly maintain Fire extinguishing equipment and inspect them at regular intervals of not less than once in a year by the responsible person and a record of such inspections maintained;
- 27.1.5 Portable fire extinguishers provided in the operator's cabin of earthmoving machinery, material handling systems, construction equipment etc. shall be regularly inspected, maintained and replenished/refilled;
- 27.1.6 The operators and the helpers of such equipment shall be trained in the methods operating the equipment and fighting the fire effectively;
- 27.1.7 All combustion engine power equipment shall be so located that the exhausts are well away from combustible material;
- 27.1.8 No smoking shall be allowed at or in the vicinity of operations, which constitute fire hazards and shall be conspicuously posted with No smoking or open flame **signs**;
- 27.1.9 In the flammable environment as described in IS: 9570, the electrical fittings and equipment shall be of flame proof type conforming to IS: 2206 & IS; 2148;
- 27.1.10 Arrangements shall be made to contain sparks generated during welding, cutting or other operations and spark shall not be allowed to fall down on combustible material kept below; All means of exit shall be kept free of obstruction at all times;
- 27.1.11 Appropriate type of fire extinguishers according to IS: 5698 shall be kept in fully charged condition at the places which have potential risk of fire;
- 27.1.12 The contractor shall educate his or his sub-contractors' men working in the vicinity of fire risk, on how to operate these equipment and know in particular circumstances which type of extinguishers is to be used;
- 27.1.13 The contractor shall take full responsibility for the upkeep and replenishment/refilling of the fixed and portable fire extinguishers.

APPENDIX

Annexure I

IMPORTANT INDIAN STANDARDS RELATED TO SAFETY

Personal Protection

- IS: 1179-1967 Equipment for eye and face protection during welding
- IS: 4770-1991 Rubber gloves for electrical purposes
- IS: 8519-1977 Guide for selection of industrial safety equipment for body protection
- IS: 8520-1977 Guide for selection of industrial safety equipment for eye, face & ear protection
- IS: 8807-1978 Guide for selection of safety equipment for protection of arms and hands
- IS: 1224-1985 Safety shoes
- IS: 2925-1984 Safety helmets
- IS: 8940-1978 Code of practice for maintenance and care of industrial safety equipment eye and face protection
- IS: 8990-1978 Code of practice for maintenance and care of industrial safety clothing
- IS: 10667-1983 Guide for selection of industrial safety for protection of foot and leg
- IS: 816-1969 Code of practice for safety and health requirements in electric and gas welding and cutting operations
- IS: 818-1968 Code of practice for safety and health requirements in electric and gas welding and cutting operations
- IS: 7194-1994 Assessment of noise exposure during work for hearing conservation purposes

Civil Engineering Construction

- IS: 2750- 1967(Part II) Steel scaffolds
- IS: 875-1987 Structural safety of building: loading standards
- IS: 4014-1967 Code of practice for steel tubular scaffolding
- IS: 3696 Safety code of scaffolds and ladders
- IS: 4138-1977 Safety code for working in compressed air
- IS: 4912-1978 Safety requirements for floor and wall openings, railings and toe boards
- IS: 7293-1974 Safety code for working with construction machinery
- IS: 9944-1992 Recommendations on safe working load for natural and man-made rope slings
- BS: 1129 Portable timber ladders, steps, Trestles & lightweight staging
- BS: 1139 Metal scaffolds
- BS: 5973 Code of practice for access & working scaffolds
- BS: 5974 Code of practice for temporary installed scaffolds and access equipment
- BS: 5975 Code of practice for falsework

Fire Protection

- IS: 2190-1992 Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers
- IS: 5896 Code of practice for selection, operation and maintenance of fire-fighting appliances

IS: 8433-1984 Code of practice for dissolved acetylene cylinders

Electrical

IS: 3043-1987 Code of practice for earthing

IS: 5424-1969 Rubber mats for electrical purposes

IS: 3646 (Part II) Artificial lightings

IS: 2148 & IS: 2206 Flame proof electrical fittings

Machinery

IS: 1860-1980 Code of practice for installation, operation and maintenance of electric passenger and goods lifts

IS: 1991-1987 Safety requirements for the use, care and protection of abrasive grinding wheels

IS: 5903-1970 Safety devices for gas cylinders

IS: 8216-1976 Guide for inspection of lift wire ropes

IS: 8964-978 Recommendations for safety conditions for woodworking machines

IS: 9474-1980 Principles of mechanical guarding of machinery

IS: 11461-1985 Code of practice for compressors safety

IS: 13367-1992 Code of practice for safe use of cranes

BASIC STRUCTURE OF SAFETY PLAN

- 01- Safety Policy
- 02- When was the Safety Policy last reviewed
- 03- Details of implementation procedure / methods to implement Safety Policy / Safety Rules
- 04- Qualification & Experience of Safety Officers
- 05- Review of Accidents analysis - Methods to ensure safety & health and steps identified for prevention of accidents
- 06- Unit/site Executive responsible for ensuring safety at various levels in the workplace
- 07- List of Employees trained in safety at the commencement of execution of the job; details of training – its module and contents
- 08- Safety Training Targets, Schedules, Methods to be adopted for providing safety training to all employees
- 09- Details of checklists for different jobs/ work & responsible persons to ensure Compliance
- 10- Regular Safety Inspection Methods and Periodicity and the list of members authorized
- 11- Risk Assessment, Safety Audit by professional agencies, their Periodicity
- 12- Implementation of recommendations of Audit / Inspections. - Procedures for implementation & follow-up
- 13- Provision for treatment of Injured persons at work site
- 14- Review of overall safety by top Management and Periodicity
- 15- System for implementation of statutory provisions.
- 16- Issue of PPE to employees, Periodicity / stock on hand, etc.

Signature
Head of Organization
With Date & Stamp

Annexure - III

CONFINED SPACE WORK PERMIT

Date of Work :	Initiator:	Permit No.:
Description of work :		
Name of person supervising:		Dept./Function:
Names of workmen involved in the job :		
1	2	
3	4	
Exact Location of Work:		
JSA Referance No.		
Job Instruction & Confirmation Sheet Ref. No		
Valid From : Time Date: To Time: Date:		
Other relevant information (if any)		
Initiated by Engineer / Supervisor of Agency		Checked by Agency Safety Representative
Name		Name
Signature		Signature
Date		Date
Check list for Authorization of Work Permit		
Minimum and Mandatory Precautions		Y/ N / NA
1	Permit form filled in completely?	
2	Have wind, atmospheric, and work area conditions (e.g. cold, hot, snow, poor lighting & Ventilation etc.) been considered throughout the job so that work can be done safely?	
3	All necessary Personnel Protective Equipment like Breathing Set, Waist Rope, Light Mounted Helmet etc. is put on by all the workmen?	
4	A lifeline, a rope tied on the safety belt of the person entering the confined space is provided?	
5	All practicable measures are taken to ensure that the atmosphere inside is not deficient in oxygen and does not contain flammable vapors and no hazardous gases like H2S. (Open at least 2 manholes & keep for 2 hours)?	
6	One fully trained person is stationed at ground level/outside to assist the inside workers and emergency contact No's available?	
7	All the workers trained for emergency?	

8	Safe means of access and egress provided?	
9	Is the suitable fire extinguisher available at work location?	
10	Are they Using only 24V lamps & working tools inside the confined space?	
Following additional precautions need to be taken before the start of the work		
Permit Issued By:		
	Approved by Principal Agency work in charge	Endorsed by Principal Agency HSE Dept
Name		
Signature		
Date		
Permit Close Out by: Name & Signature (Principal Agency)		
Date :		Time :
Note: All extra information on preparation and precautions to be provided on the reverse side of this PTW.		

HOT WORK PERMIT

Date of Work :		Initiator:		Permit No.:	
Description of work :					
Name of person supervising:			Dept./Function:		
Names of workmen involved in the job :					
1		2			
3		4			
Exact Location of Work:					
JSA Referance No.					
Job Instruction & Confirmation Sheet Ref. No					
Valid From : Time Date: To Time: Date:					
Other relevant information (if any)					
Initiated by Engineer / Supervisor of Agency			Checked by Agency Safety Representative		
Name				Name	
Signature				Signature	
Date				Date	
Exact location of work					
Relevant information					
Check list for Authorization of Work Permit					
Minimum and Mandatory Precautions					Y/ N / NA
1	Permit form filled in completely?				
2	Form filled in correctly and in full.				
3	Has the work area been inspected for any abnormalities - specify on wind, atmosphere, surroundings, etc.				
4	Are the necessary PPE provided and do the workmen know their use?				
5	Is the fitter, experienced and knowledgeable enough to carry out the job?				
6	Area has to be cleared of any flammables and combustible material.				
7	Electrical equipment to be protected and grounded.				
8	Are fire-fighting equipment - extinguishers, water, sand buckets etc, located nearby for ready in case of any mishap?				
9	Gas cylinders in upright state/ trolleys/ flash-back arrestors/ hose condition/ NRVs, etc.				
10	Is the area easily accessible?				

Additional precautions to be taken:		
This permit is valid only for one week. A fresh hot work permit has to be taken for continued works for the next week.		
Permit Issued By:		
	Approved by Principal Agency work in charge	Endorsed by Principal Agency HSE Dept
Name		
Signature		
Date		
Permit Close Out by: Name & Signature (Principal Agency)		
Date :		Time :
Note: All extra information on preparation and precautions to be provided on the reverse side of this PTW.		

PERMIT FOR LIFTING OF MATERIAL

Date of Work :		Initiator:		Permit No.:	
Description of work:					
Name of person supervising:			Dept./Function:		
Names of workmen involved in the job :					
Exact Location of Work:					
JSA Reference No.					
Job Instruction & Confirmation Sheet Ref. No					
Valid From : Time Date: To Time: Date:					
Other relevant information: (If any)					
Initiated by Engineer / Supervisor of agency			Checked by Agency Safety Representative		
Name				Name	
Signature				Signature	
Date				Date	
Check list for Authorization of Work Permit					
1	Details of type of crane(s) to be used?				
2	Name of Lift Co-ordinator, Rigger/Crane Operator?				
3	Adequate and suitable lifting gears available and in good condition				
4	Have soil, wind, atmospheric, and work area conditions (e.g. cold, hot , snow, poor lighting & Ventilation etc.) been considered throughout the job so that work can be done safely?				
5	Lifting Equipments, Lifting gears and Slings are tested and certified?				
6	Are all operators trained, competent and healthy (Having Licenses / Experience Certificate)?				
7	Are all the examinations and tests carried out on the equipment (Crane) and certified by competent persons?				
8	Is the safe working load (SWL) marked on all lifting tools & tackles?				
9	Lifting area cordoned off?				
10	Tag lines provided to control the swing of load?				
11	Load tied properly and secured against toppling and falling?				
12	Signalman/Rigger is provided and competent?				
13	Proper communication available between operator and rigger?				
14	Is the vehicle for transportation adequate for the load?				

Following additional precautions need to be taken before the start of the work:			
Permit Issue b By:			
Approved by Principal agency work incharge		Endorsed by main agency HSE Dept	
Name		Name	
Signature		Signature	
Date		Date	
Permit Close Out by: Name & Signature (Main agency)			
Date :		Time :	
Note: All extra information on preparation and precautions to be provided on the reverse side of this PTW.			

WORKING AT HEIGHT PERMIT

Date of Work :	Initiator:	Permit No.:
Description of work :		
Name of person supervising:		Dept./Function:
Names of workmen involved in the job :		
1	2	
3	4	
Exact Location of Work:		
JSA Referance No.		
Job Instruction & Confirmation Sheet Ref. No		
Valid From : Time Date: To Time: Date:		
Other relevant information		
Initiated by Engineer / Supervisor		Checked by Agency Safety Representative
Name		Name
Signature		Signature
Date		Date
Check list for Authorization of Work Permit		
Minimum and Mandatory Precautions		Y/ N / NA
1	Permit form filled in completely?	
2	Work area below is temporarily cordoned/barricaded	
3	The scaffold erected has pipes and clamps in good condition.	
4	Diagonal / lateral bracings pipes are provided to ensure stability	
5	Access ladder is provided to reach the work location	
6	Planks / sheet used in temporary platform are in good condition	
7	Planks / sheets are tied properly using binding wire	
8	Temporary platform is having temporary side railing	
9	Workers are wearing Helmet, Shoes & Safety belt in good condition.	
10	For Anchoring of safety belt at height rigid support / life rope line is provided	
11	Experienced workers are engaged for work	
12	Portable elect equip/fibre body checked for its healthiness including earthing	
13	The sling / pulley blocks / ropes are tested for fitness	

14	Workers are briefed on Safety Precautions to be taken	
	Power hand tools used at eight are connected through 30mA ELCB.	
Following additional precautions need to be taken before the start of the work		
Permit Issued By:		
	Approved by Principal Agency work in charge	Endorsed by Principal Agency HSE Dept
Name		
Signature		
Date		
Permit Close Out by: Name & Signature (Principal Agency)		
Date :		Time :
Note: All extra information on preparation and precautions to be provided on the reverse side of this PTW.		

DEFINITIONS

1. **Building or other construction work:** means the construction, alteration, repairs, maintenance or demolition, of or, in relation to, buildings, streets, roads, railways, tramways, airfields, generation, transmission and distribution of power, water works, oil and gas installations, electric lines, tunnels, bridges, viaducts, pipelines, towers, cooling towers and such other work as may be specified.
2. **Building worker:** means a person who is employed by a contractor to do any skilled, semi-skilled or manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment be expressed or implied, in connection with any building or other construction work;
3. **Establishment:** means an establishment who or which employs building workers in any building or other construction work, and includes an establishment belonging to a contractor;
4. **Contractor:** means a person who undertakes to produce a given result for any establishment, other than a mere supply of goods or articles of manufacture by the employment of building workers or who supplies building workers for any work of the establishment, and includes a sub-contractor or any other agency engaged on his behalf;
5. **Employer:** in relation to an establishment, means the owner thereof that is the contractor himself.
6. **Competent Person:** means a person so approved by the Central Government who belongs to a testing establishment in India possessing adequate qualification, experience and skill for the purpose of testing, examination or annealing and certification of lifting appliances, lifting gears, wire ropes or pressure plant or equipment;
7. **Responsible Person:** means a person appointed by the employer to be responsible for the performance of specific duty or duties and who has sufficient knowledge and experience and the requisite authority for the proper performance of such duties;
8. **Danger:** means danger of accident or of injury or danger to health;
9. **Hazard:** means danger or potential danger;
10. **Hazardous substance:** means any substance, which due to its explosiveness, inflammability, radioactivity, toxic or corrosive properties and similar hazardous characteristics may Cause injury; or Affect adversely the human system; or Cause loss of life or damage to property or environment;
11. **Hazardous Process:** comprises roof work, steel erection, and work under and over water, demolition and work in confined space;

12. **National Standard:** means standards as approved by the Bureau of Indian Standards (BIS) and in the absence of such standards, the standards approved by the Central Government for a specific purpose;
13. **Lifting Appliance:** means a crane, hoist, derrick, winch, jack, pulley block or other equipment used for lifting materials, objects or building workers;
14. **Lifting gear:** means ropes, chains, hooks, slings and other accessories of a lifting appliance;
15. **Safe Operating Practice:** Means the practice followed in building and construction activities for the safety of workers and for safe operation of machinery and equipment used in such activities. Such practices shall conform to all or any of the following:
 - Relevant Standards approved by BIS;
 - National Building Codes;
 - Manufacturer's instruction on safe use of equipment and machinery;
 - Code of practice on safety in construction industry published by International Labour Organization .
16. **Safe working load:** in relation to an article of lifting gear or lifting appliance, means the load which is the maximum load that may be imposed on such article or appliance with safety in the normal conditions as assessed and certified by a competent person;
17. **Workplace:** means all places where building workers are required to be present or to go for work and which are under the control of an employer;
18. **Personal Protective Equipment (PPE):** are the protective devices made available for individual or collective use of the workers likely to be affected by the hazards of the workplace or process;
19. **Construction & Erection Manual (E&C) Rules:** all references to E&C Manual shall mean the Construction & Erection Rules that are detailed hereunder;
20. **Engineer in-charge:** All references to the Engineer in-charge shall mean the person in-charge of a building and construction of the NTPC.
21. **Interpretation of words not defined: words and expressions not defined or used in this Manual shall have the same meaning as generally assigned in common engineering practices**

Annexure-C to General Conditions of Contract

Standard Operating Procedures (SOPs) for IE

Investigations by Independent Engineer for any contentious issue / disagreement shall be as per pre-defined Standard Operating Procedure (SOP). IE shall strictly follow the SOPs and will also document and maintain all the records. Following is a representation of the SOPs for IE for processing key tasks, roles and responsibilities and commensurate timelines.

Based on the preliminary hearing of the Parties, IE shall prescribe resolution timeline depending upon the number and nature of disagreements subject to a maximum duration of thirty (30) days.

Key Task	Stakeholder involvement	Activity Description	Proposed Timeline
1 Disagreement Filing	Contractor Client	Case Filing – A disagreement case begins when claimant party submits a demand for intervention by IE in the prescribed format along with documentary evidence. Demand without initial documentary evidence will not be admissible for IE intervention.	Day 0
2 Preliminary Hearing & Scheduling	Independent Engineer Contractor Client	Preliminary hearing and scheduling process - IE to organize a preliminary hearing with the parties and prescribe suitable timeline for resolution or settlement.	Day 1 to Day 6
3 Finalisation of Issues	Independent Engineer	Finalisation of Issues – After due examination and diligence to finalise the issues requiring resolution.	Day 3 to 9
4 Hearing/ Mediation	Independent Engineer Contractor Client	Hearing / Mediation –The parties and IE meet in person to conduct the Hearings.	Day 4 to 12
5 Inspection	Independent Engineer	Inspection - IE conducts the inspections involving field measurements, if any, to further investigate evidence conferred to the IE by both parties during the hearing.	Day 5 to 17
6 Post Inspection Briefs	Independent Engineer Contractor Client	Post-Inspection Briefs - After the inspection takes place; both the parties may come up with additional testimony, as permitted by the IE.	Day 10 to 30
7 Closure	Independent Engineer	Closure - IE closes the report on the case and issues a decision, along with any claim settlement, if applicable.	Day 10 to 30

Annexure-D to General Conditions of Contract

Standard Format for Disagreement Case Filing (Indicative)

In line with the SOPs, an IE expert should follow a standard format provided below for disagreement case filing and further investigations.

Disagreement Documentation Report (to be filled by Independent Engineer)

1. Name of Party	2. Disagreement Reporting Date	3. Has the documentary Evidence been Submitted
		<input type="checkbox"/> Yes
4. Contract Reference number	5. Party Representative Name Reporting Disagreement	<input type="checkbox"/> No
	Name: _____ Contact _____	<input type="checkbox"/> Not Applicable
Details: _____		
6. Name of Independent Engineer(IE)	7. IE Contact details	8. Disagreement Reference Number Allocated by IE
9. Supplementary Note Recording the Disagreement		
[Text]		
<i>Documentary Evidences to be Annexed</i>		
10. Critical Engineering Expertise Relevant to investigate the Disagreement (Check All Required)		
<input type="checkbox"/> Engineering Design	<input type="checkbox"/> Geology	<input type="checkbox"/> Civil Works
<input type="checkbox"/> Hydro Mechanical	<input type="checkbox"/> Electro Mechanical	<input type="checkbox"/> Electrical Switchgear
<input type="checkbox"/> Quality Assurance & Inspection		
11. Record Notes of Preliminary hearing Organized by IE with the parties		
[Text]		
<i>Documentary Evidences by Parties along with MoM to be Annexed</i>		
12. Brief Narration on discovery process - after Preliminary hearing & listing of next step to examine the issues and procedural difficulties relating to the case		
[Text]		
<i>Documentary Evidences to be Annexed</i>		
13. Record notes of Hearing/Mediation between the parties and IE		
[Text]		
<i>Documentary Evidences with Video Records to be Annexed</i>		
14. Inspection Records with Field Measurements Conducted by IE		
[Text]		
<i>Documentary Evidences to be Annexed</i>		
15. Record notes of Inspection Briefs by IE along with additional testimony by the Parties if any		
[Text]		
<i>Documentary Evidences & Inspection Reports to be Annexed</i>		
16. Closure Report by IE with Decision & Claim settlement if applicable		
[Text]		
<i>Documentary Evidences to be Annexed</i>		
Final Acceptance by All the Parties		

***NTPC VIDYUT VYAPAR NIGAM
LIMITED***

(A wholly owned Subsidiary of NTPC Limited)



SECTION – V

SPECIAL CONDITION OF CONTRACT (SCC)

Special Condition SCC Nos.	GCC Clause Ref, If any	Special Conditions
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SECTION - V

SPECIAL CONDITIONS OF CONTRACT

The following Special Conditions of Contract (SCC), Section-V, shall supplement/amend the General Conditions of Contract (GCC), Section-IV. Wherever there is a conflict, the provisions in SCC shall prevail over those in the GCC. The corresponding clause number of the GCC is indicated in parentheses.

Name of Package: **ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)**

Bid Document No.: **NVVN / C&M / RE-333 / 2024-25**

1.	Definitions (GCC Clause 1)	<p>The Employer is:</p> <p>Name of Employer: NTPC Vidyut Vyapar Nigam Limited</p> <p>Address of Employer: NTPC Vidyut Vyapar Nigam Limited 5th Floor, Engineering Office Complex, Plot No. A-8A, Sector-24, Noida-201301 State of U.P. India Telephone No. (+91) - (120) – 4947239</p> <p>The Project Manager is :</p> <p>Name of Project Manager: NVVN Representative</p> <p>Address of Project: Hope Town, Sri Vijayapuram, A&N islands, India</p> <p>Time for Completion:</p> <p>Time for completion of Facilities from the date of Notification of Award shall be 28 months.</p>
----	-------------------------------	--

Special Condition SCC Nos.	GCC Clause Ref, If any	Special Conditions																																																	
1.2	Time for commencement & Completion (GCC Clause 8.2)	Time for completion of Facilities from the date of Notification of Award shall be 28 months.																																																	
		<table border="1"> <thead> <tr> <th rowspan="2">Sl. No.</th> <th rowspan="2">Activity/ Description of Milestones</th> <th colspan="2">Duration in Months from NoA</th> </tr> <tr> <th>Start</th> <th>Finish</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Basic Engineering</td> <td>00</td> <td>04</td> </tr> <tr> <td>2</td> <td>Detailed Engineering</td> <td>-</td> <td>09</td> </tr> <tr> <td>3</td> <td>Completion of Ordering of BOIs (Bought out Items)</td> <td>-</td> <td>06</td> </tr> <tr> <td>4</td> <td>Commencement of Manufacturing</td> <td>05</td> <td>-</td> </tr> <tr> <td>5</td> <td>Supply of Materials</td> <td>08</td> <td>20</td> </tr> <tr> <td>6</td> <td>Establishment of Site Office, Storage Facilities & Mobilisation</td> <td>-</td> <td>06</td> </tr> <tr> <td>7</td> <td>Equipment Erection Works* (Mechanical, Electrical, C&I)</td> <td>09</td> <td>24</td> </tr> <tr> <td>8</td> <td>Progressive Commissioning of Gas Engine Modules</td> <td>24</td> <td>26</td> </tr> <tr> <td>9</td> <td>Completion of Facilities</td> <td>-</td> <td>28</td> </tr> <tr> <td>10</td> <td>Supply of Mandatory Spares</td> <td>-</td> <td>22</td> </tr> </tbody> </table>				Sl. No.	Activity/ Description of Milestones	Duration in Months from NoA		Start	Finish	1	Basic Engineering	00	04	2	Detailed Engineering	-	09	3	Completion of Ordering of BOIs (Bought out Items)	-	06	4	Commencement of Manufacturing	05	-	5	Supply of Materials	08	20	6	Establishment of Site Office, Storage Facilities & Mobilisation	-	06	7	Equipment Erection Works* (Mechanical, Electrical, C&I)	09	24	8	Progressive Commissioning of Gas Engine Modules	24	26	9	Completion of Facilities	-	28	10	Supply of Mandatory Spares	-	22
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10	Supply of Mandatory Spares	-	22																																																
2.0	Definitions																																																		

Special Condition SCC Nos.	GCC Clause Ref, If any	Special Conditions		
6.0. 6.1 6.2	(GCC Clause 13) GCC Clause 25.2.1 Completion Time Guarantee (GCC 26.1) Completion Time Guarantee(GCC clause 26.2	<p>The Contractor shall, within twenty-eight (28) days of the Notification of Award, provide securities for the due performance of the Contract for ten percent (10%) of the Contract Price of all the Contracts, with an initial validity up to ninety (90) days beyond the end of scheduled Defect Liability Period of the last equipment covered under the Contract.</p> <p>However, in case of delay in completion of the defect liability period, the validity of all the contract performance securities shall be extended by the period of such delay.</p> <p>The Guarantee test of the Facilities shall be successfully completed within 18 months from the date of completion of the respective facilities.</p> <p>Time for Completion of Facilities from the date of Notification of Award shall be 28 months</p> <p>Applicable rate for liquidated damages :</p> <p>Liquidated Damages for delay in successful completion of Facilities shall be as under :</p> <p>a) It is expressly understood and agreed that if the contractor fails to achieve successful Completion of facilities within the agreed work schedule, the Contractor shall pay to the Employer as liquidated damages and not as penalty, a sum calculated at the following rates :</p> <table border="1"> <tr> <td>(0.5% of the total contract value divided by 7) per day of the contract value corresponding to the capacity not commissioned</td> <td>for each day of delay in successful Completion of Facilities under the package as per the scope of work of the Contractor under the Contract.</td> </tr> </table>	(0.5% of the total contract value divided by 7) per day of the contract value corresponding to the capacity not commissioned	for each day of delay in successful Completion of Facilities under the package as per the scope of work of the Contractor under the Contract.
(0.5% of the total contract value divided by 7) per day of the contract value corresponding to the capacity not commissioned	for each day of delay in successful Completion of Facilities under the package as per the scope of work of the Contractor under the Contract.			

Special Condition SCC Nos.	GCC Clause Ref, If any	Special Conditions												
7.0	GCC Clause 28	<p>b) The liquidated damages for delay in project including supply of spares beyond the dates stipulated under the Contract shall be as follows:</p> <p>One half of one percent (1/2%) of CIF (Indian port-of-entry)/ Ex-works (India) price of the delayed Mandatory Spares, per week or part thereof of delay, subject to maximum of five percent (5%) of the total CIF / Ex-works price of all mandatory spares included in the Scope of Work of the Contractor under the Contract.</p> <p>c) Maximum deduction for liquidated damages:</p> <p>The amount of liquidated damages for delay shall be subject to a maximum of 5% of the total Contract Price [total of First, Second & Third contract]</p> <p>Following to be read in conjunction with Functional Guarantee wherever appearing</p> <p>The words "Appendix-8 (Functional Guarantee)" appearing in the GCC Clause 28 and at any other places in bidding documents shall be read in conjunction with Technical Specification, Section-VI of BiddingDocuments.</p>												
8.0	New Clause	<p>Liquidated Damages for Performance Guarantees shall be as follows:</p> <table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Guarantee</th> <th>Rate of Liquidated Damages</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>Net Heat Rate</td> <td></td> </tr> <tr> <td></td> <td>Net Heat Rate at 100% of Engine Load</td> <td>600923 (INR/(Kcal/Kwh)/MW) X ΔHRg X (Y/1000)</td> </tr> <tr> <td>ii)</td> <td>Net Output</td> <td>314176 (INR/KW) X ΔY</td> </tr> </tbody> </table> <p>where:</p>	Sl. No.	Guarantee	Rate of Liquidated Damages	(i)	Net Heat Rate			Net Heat Rate at 100% of Engine Load	600923 (INR/(Kcal/Kwh)/MW) X ΔHRg X (Y/1000)	ii)	Net Output	314176 (INR/KW) X ΔY
Sl. No.	Guarantee	Rate of Liquidated Damages												
(i)	Net Heat Rate													
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ii)	Net Output	314176 (INR/KW) X ΔY												

Special Condition SCC Nos.	GCC Clause Ref, If any	Special Conditions
9.0		<p>Δ HRg Increase in net Heat Rate at 100% of net output of Engine from guaranteed value in Kcal/Kwh.</p> <p>Y Guaranteed net power output of each Engine quoted by bidder in KW at 100% load. The net Output shall be restricted by the upper limit of the range prescribed for the plant.</p> <p>Δ Y Decrease in net Power Output of Engine with RLNG from guaranteed value in KW.</p> <p>Note:</p> <ol style="list-style-type: none"> 1. Contractor's aggregate liability to pay liquidated damages for failure to attain the Functional guarantee shall not exceed twenty five percent (25%) of the Contract Price. 2. Each of the liquidated damages specified above shall be independent and these Liquidated damages shall be levied concurrently as applicable. <p>ANNEXURES TO SCC</p> <ol style="list-style-type: none"> 1. ANNEXURE-I: LIST OF BANKS NTPC's Letter dated 03.09.2014 to SBI 2. ANNEXURE-II: NOT APPLICABLE 3. ANNEXURE-III : DETAILS OF CERTIFICATES REGARDING CONTRACT CLOSING 4. ANNEXURE-IV: RESTRICTIONS ON CONTRACTORS/SUB-CONTRACTORS FROM A COUNTRY WHICH SHARES LAND BORDER WITH INDIA. 5. ANNEXURE-V: Not used 6. ANNEXURE-VI: Panel of Conciliation Committees of Independent Experts (CCIE)

**LIST OF BANKS ACCEPTABLE FOR SUBMISSION
OF BANK GUARANTEE FOR ADVANCE PAYMENTS, PERFORMANCE SECURITIES AND
SECURITIES FOR DEED OF JOINT UNDERTAKING**

SCHEDULED COMMERCIAL BANKS

A. STATE BANK OF INDIA

B. NATIONALISED BANKS

- 1 Bank of Baroda
- 2 Bank of India
- 3 Bank of Maharashtra
- 4 Canara Bank
- 5 Central Bank of India
- 6 Indian Overseas Bank
- 7 Indian Bank
- 8 Punjab National Bank
- 9 Union Bank of India
- 10 Punjab & Sind Bank
- 11 UCO Bank

C. SCHEDULED PRIVATE BANKS (INDIAN BANKS)

- 1 Axis Bank Ltd
- 2 Bandhan Bank Limited
- 3 CSB Bank
- 4 City Union Bank
- 5 DCB Bank Ltd
- 6 Dhanlaxmi Bank Ltd
- 7 Federal Bank Ltd
- 8 HDFC Bank Ltd
- 9 ICICI Bank Ltd
- 10 IndusInd Bank Ltd
- 11 IDFC FIRST Bank Limited
- 12 Jammu & Kashmir Bank Ltd
- 13 Karnataka Bank Ltd
- 14 Karur Vysya Bank Ltd
- 15 Kotak Mahindra Bank
- 16 Lakshmi Vilas Bank Ltd
- 17 Nainital Bank Ltd
- 18 RBL Bank Limited
- 19 South Indian Bank Ltd
- 20 Tamilnad Mercantile Bank Ltd
- 21 Yes Bank Ltd
- 22 IDBI Bank Ltd.

D. SCHEDULED PRIVATE BANKS (FOREIGN BANKS)

- 1 AB Bank Ltd
- 2 Abu Dhabi Commercial Bank PJSC

ANNEXURE-I TO SPECIAL CONDITIONS OF CONTRACT

- 3 American Express Banking Corporation
- 4 Australia & Newzealand Banking Group Limited
- 5 Barclays Bank Plc
- 6 Bank of America
- 7 Bank of Bahrain & Kuwait B.S.C.
- 8 Bank of Ceylon
- 9 Bank of China Limited
- 10 Bank of Nova Scotia
- 11 BNP Paribas
- 12 Citi Bank NA
- 13 Cooperatieve Rabobank UA
- 14 Crédit Agricole Corporate and Investment Bank
- 15 Credit Suisse AG
- 16 CTBC Bank Co Ltd
- 17 DBS Bank India Ltd
- 18 Deutsche Bank A.G.
- 19 Doha Bank Q.P.S.C
- 20 Emirates NBD Bank (PJSC)
- 21 First Abu Dhabi Bank PJSC
- 22 FirstRand Bank Ltd
- 23 HSBC Ltd
- 24 Industrial & Commercial Bank of China Ltd
- 25 Industrial Bank of Korea
- 26 JP Morgan Chase Bank, National Association
- 27 JSC VTB Bank
- 28 KEB Hana Bank
- 29 Kookmin Bank
- 30 Krung Thai Bank Public Company Ltd
- 31 Mashreq Bank PSC
- 32 Mizuho Bank Ltd
- 33 MUFG Bank, Ltd
- 34 NatWest Markets Plc
- 35 PT Bank Maybank Indonesia TBK
- 36 Qatar National Bank (Q.P.S.C.)
- 37 Sberbank
- 38 SBM Bank (India) Ltd
- 39 Shinhan Bank
- 40 Societe Generale
- 41 Sonali Bank Ltd
- 42 Standard Chartered Bank
- 43 Sumitomo Mitsui Banking Corporation
- 44 United Overseas Bank Ltd
- 45 Westpac Banking Corporation
- 46 Woori Bank

Note - Any Addition/ Deletion/ Modification in Bank list shall be as per changes in Second Schedule List by RBI from time to time.

*** Bidder to take note of NTPC letter ref. NTPC/FC/CS/BG/01 dated 03.09.2014 and SBI letter ref. CAG-I/AMT-1/2014-15/370 dated 04.09.2014 attached herewith this Annexure-I to SCC.**



एन टी पी सी लिमिटेड
(भारत सरकार का उद्यम)

NTPC Limited
(A Govt. of India Enterprise)

केन्द्रीय कार्यालय/Corporate Centre

Date : 03rd September 2014

Ref. No.: NTPC/FC/CS/BG/01
Deputy General Manager,
State Bank of India,
CAG Branch,
12 th floor, Jawahar Vyapar Bhavan, 1, Tolstoy Marg,
New Delhi 110 001

Kind Atten: Sh. Sandeep Mishra

Sub: Format of the Bank Guarantee (BG) issued by State Bank of India – reg.

Dear Sir,

NTPC Limited is India's largest Power Company and a 'Maharatna PSU' with a significant presence in the entire value chain of power generation business. The procurement process of NTPC requires its participating Bidders to submit Bank Guarantees (BGs) as Bid security/other securities in a fixed format provided by NTPC.

It has been observed recently that BGs issued by various branches of State Bank of India are inserting the following additional clause.

QUOTE

Notwithstanding anything contrary contained in any law for the time being in force or banking practice, this guarantee shall not be assignable or transferable by the beneficiary. Notice or invocation by any person such as assignee, transferee of agent of beneficiary shall not be entertained by the bank. Any invocation of guarantee can be made only by the beneficiary directly.

UNQUOTE

The inclusion of the aforesaid clause in the BGs restricts the rights of NTPC under the BG and it may not be possible for NTPC to accept the aforesaid clause in the BGs submitted to us by our Bidders. It may also be mentioned that incorporation of the above additional clause in the BG results in the BG being returned by NTPC and consequently rejection of the bids of parties that have submitted such BGs.

In view of the above, it is requested that please take up at appropriate levels so that suitable instructions are issued to all your branches not to incorporate any such additional clause and henceforth BGs may be issued strictly as per NTPC format only.

Kindly acknowledge the receipt of this letter

Yours faithfully,

(K.P.Gupta)

General Manager (Finance)

Copy for Kind information: ED(CC&M) for kind info of u.s

एन टी पी सी भवन स्कोप कॉम्प्लेक्स, 7, इंस्टीट्यूशनल एरिया, लोधी रोड, नई दिल्ली-110003 टेल/Tel.: 24360100, फैक्स/Fax : 011-24361018
NTPC Bhawan, SCOPE Complex, 7, Institutional Area, Lodhi Road, New Delhi-110003, वेबसाइट/Website : www.ntpc.co.in



भारतीय स्टेट बैंक
State Bank of India

कॉरपोरेट लेखा समूह शाखा, जवाहर व्यापार भवन,
11-12 वां तल, 1, टॉलस्टाय मार्ग, नई दिल्ली-110 001
Corporate Accounts Group Branch, Jawahar Vyapar Bhawan,
11th & 12th Floor, 1, Tolstoy Marg, New Delhi-110 001

Tel. : 23374525, 23374505, 23374541 (AMT-1), 23353022 (DGM & COO), 23701043, 23359506 (A & A), 23352995 (CS), 23352968 (IB)
Fax : 23353101 (Sectt.), 23352793 (CS), 23353029 (IB)

Shri K.P. Gupta,
General Manager (Finance),
NTPC Limited
Scope Complex, 7, Institutional Area,
Lodhi Road,
New Delhi: 110 003.

CAG-I/AMT-1/2014-15/370

04.09.2014

Dear Sir,

Format of the Bank Guarantee (BG) issued by State Bank of India

We refer to your letter dated 3rd September 2014 wherein you have requested for excluding bidders/vendors of NTPC from insertion of additional Clause restraining assignment/transferability of BG.

Looking at our relationship with NTPC, as a very special case, we have since obtained waiver from our Authorities for excluding NTPC from insertion of the referred clause for BGs issued in your favour.

We are taking steps to issue suitable instructions to our offices for exclusion of this clause for BGs issued in favour of NTPC. In case any bidder or vendor submits to you a Bank Guarantee issued by any of our Branches containing the additional clause as mentioned above, request you to please bring it to our notice and advise us so that we can take-up with the concerned Branch for excluding it.

This is for your information and necessary action please.

Yours faithfully,


(Sandeep Mishra)

Deputy General Manager &
Relationship Manager, AMT-1

CONTRACT CLOSING CERTIFICATES

CERTIFICATE NO.	CERTIFICATE DESCRIPTION	RESPONSIBILITY	LIMITING DATES FOR ISSUANCE OF CERTIFICATE
CCP-01	Certificate of Final Amendment to the Contract	Corporate Contract Services	7 Months from Completion of Facilities
CCP-02	Drawing Receipt Certificate	Corporate Engineering	2 Months from Completion of Facilities
CCP-03	QA Documents Receipt Certificate	CQA&I	2 Months from Completion of Facilities
CCP-04	O&M Manual Receipt Certificate	Corporate Engineering	4 Months from Completion of Facilities
CCP-05	Scope Completion Certificate	Site Erection	8 Months from Completion of Facilities
CCP-06	Liquidated Damages for Delay Certificate		
(a)	For cases where LD for delay is settled by Corporate Contracts	Corporate Contract Services	7 Months from Completion of Facilities
(b)	For cases where LD for delay is settled by the Regions/ Site	Concerned Site/ Regional offices	7 Months from Completion of Facilities
CCP-07	Shortfall in Equipment Performance Certificate	<ul style="list-style-type: none"> • Corporate OS : Site Performance Test-Cat-I • Regional OS: Site Performance Test-Cat-II • Site : Site Performance Test-Cat-III • CQA&I : Shop Test 	5 Months from Performance and Guarantee (PG) Tests
CCP-08	"Material Reconciliation" Certificate	Site Erection & Site Materials Mgmt.	6 Months from Completion of Facilities
CCP-09	"Payment Reconciliation" Certificate : Indian Contractor	Site Finance	6 Months from Completion of Facilities
CCP-10	Certificate regarding Labour Payments and Statutory Requirements to be furnished by Contractor.	Contractor	9 Months from Completion of Facilities
CCP-11	"No Demand Certificate" by Contractor	Contractor	6 Months from PG Tests
CCP-12	Certificate for Completion of Warranty Period	Site Erection	14 Months from Trial Operation/ Completion of Facilities

CONTRACT CLOSING CERTIFICATES

CERTIFICATE NO.	CERTIFICATE DESCRIPTION	RESPONSIBILITY	LIMITING DATES FOR ISSUANCE OF CERTIFICATE
CCP-13	Certificate for Return of BGs/ Insurance Surety Bonds/Indemnity Bonds etc.	Site Finance/ Corporate Finance	All BGs except CPG: 5 Month from Trial Operation / Completion of Facilities CPG: 15Months from Trial Operation/ Completion of Facilities

ANNEXURE-IV to SCC

F. No. DPE/7(4)/2017-Fin.
Government of India
Ministry of Finance
Department of Public Enterprises

Block No. 14, CGO Complex,
Lodi Road, New Delhi-110003
Dated the 24th February, 2023

To,

Chief Executives of all CPSEs

Subject:- Restrictions under Rule 144(xi) of the General Financial Rules
(GFRs), 2017 - regarding

Sir/Madam,

The undersigned is directed to reiterate the instructions as contained in
Department of Expenditure O.M. No. 7/10/2021-PPD(1) dated 23rd February, 2023
(copy enclosed) to all CPSEs for their information and strict compliance.

Encl : As stated


(Kailash Bhandari)
Deputy Director
Tel : 2436-6247

Copy to :- Shri Kanwalpreet, Director (PPD), Department of Expenditure, Room No.
264-C, North Block, New Delhi.

No.F.7/10/2021-PPD (1)
Government of India
Ministry of Finance
Department of Expenditure
Procurement Policy Division

264-C, North Block, New Delhi.
23.02.2023.

Order (Public Procurement No. 4)

Subject: Restrictions under Rule 144(xi) of the General Financial Rules (GFRs), 2017.

Attention is invited to Order (Public Procurement No. 1) issued vide F.6/18/2019-PPD dated 23.07.2020, Order (Public Procurement No. 2) issued vide F.6/18/2019-PPD dated 23.07.2020, Order (Public Procurement No. 3) issued vide F.6/18/2019-PPD dated 24.07.2020, Office Memorandum (OM) No. F.18/37/2020-PPD dated 08.02.2021, OM No. F.12/1/2021-PPD(Pt.) dated 02.03.2021 and OM No. F.7/10/2021-PPD dated 08.06.2021. In this regard, the following is hereby ordered under Rule 144(xi) (as amended vide OM No. F.7/10/2021-PPD dated 23.02.2023) on the grounds stated therein, in supersession to all of the above mentioned Orders/ clarifications:

Requirement of registration:

2. Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with the Competent Authority, specified in **Annexure I**.

3. Any bidder (including an Indian bidder) who has a Specified Transfer of Technology (ToT) arrangement with an entity from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with the Competent Authority, specified in **Annexure I**.

4. The requirement of registration for cases covered by paragraph 2 above has been applicable since 23.07.2020. The requirement of registration for bidders covered by paragraph 3 above will be applicable for all procurements where tenders are issued/ published after 01.04.2023.

5. In tenders issued after 23.07.2020 or 01.04.2023, as the case may be, the provisions of requirement of registration of bidders and of other relevant provisions of this Order shall be incorporated in the tender conditions.

Applicability:

6. Apart from Ministries/ Departments, attached and subordinate bodies, notwithstanding anything contained in Rule 1 of the GFRs 2017, the Order shall also be applicable

- a) to all Autonomous Bodies;
- b) to all public sector banks and public sector financial institutions;
- c) to all Central Public Sector Enterprises;
- d) to all procurement in Public Private Partnership projects receiving financial support from the Government or public sector enterprises/ undertakings; and
- e) Union Territories, National Capital Territory of Delhi and all agencies/ undertakings thereof.

7. This order will not be applicable for cases falling under **Annexure II**.

Definitions:

8. "*Bidder*" for the purpose of the Order (including the term 'tenderer', 'consultant' 'vendor' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency, branch or office controlled by such person, participating in a procurement process.

9. "*Tender*" for the purpose of the Order will include other forms of procurement, except where the context requires otherwise.

10. "*Transfer of Technology*" means dissemination and transfer of all forms of commercially usable knowledge such as transfer of know-how, skills, technical expertise, designs, processes and procedures, trade secrets, which enables the acquirer of such technology to perform activities using the transferred technology independently. (Matters of interpretation of this term shall be referred to the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade, and the interpretation of the Committee shall be final.)

11. "*Specified Transfer of Technology*" means a transfer of technology in the sectors and/ or technologies, specified in paragraph 15, occurring on or after 23.07.2020.

12. "*Bidder (or entity) from a country which shares a land border with India*" for the purpose of the Order means

- (a) An entity incorporated, established or registered in such a country; or
- (b) A subsidiary of an entity incorporated, established or registered in such a country; or
- (c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
- (d) An entity whose beneficial owner is situated in such a country; or
- (e) An Indian (or other) agent of such an entity; or
- (f) A natural person who is a citizen of such a country; or

(g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

13. *Beneficial owner* for the purposes of Para 12 (d) will be as under:

(i) In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person(s), has a controlling ownership interest or who exercises control through other means.

Explanation:-

a. "Controlling ownership interest" means ownership of, or entitlement to, more than twenty-five per cent of shares or capital or profits of the company;

b. "Control" shall include the right to appoint the majority of the directors or to control the management or policy decisions, including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

(ii) In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

(iii) In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

(iv) Where no natural person is identified under (i) or (ii) or (iii) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

(v) In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

14. "*Agent*" for the purpose of the Order is a person employed to do any act for another, or to represent another in dealings with third persons.

[Note:

i. A person who procures and supplies finished goods from an entity from a country which shares a land border with India will, regardless of the nature of his legal or commercial relationship with the producer of the goods, be deemed to be an Agent for the purpose of this Order.

ii. However, a bidder who only procures raw material, components etc. from an entity from a country which shares a land border with India and then manufactures or converts them into other goods will not be treated as an Agent.]

Sensitive Sectors/ Technologies (relevant only for the provisions on ToT arrangements):

15. (i) Certain sectors and technologies have been identified as sensitive from the national security point of view. The sectors listed in Schedule I to this Order are considered Category-I sensitive sectors. The sectors listed in Schedule II to this Order are considered Category-II sensitive sectors. The technologies listed in Schedule III are considered sensitive technologies.

(ii) For Category-I sensitive sectors, bidders with ToT arrangement in any technology with an entity from a country which shares a land border with India shall require registration.

(iii) For Category-II sensitive sectors, bidders with ToT arrangement in the sensitive technologies listed in Schedule III, with an entity from a country which shares a land border with India shall require registration.

(iv) In Category-II sensitive sectors, the Secretary (or an officer not below the rank of Joint Secretary to Government of India, so authorized by the Secretary) of the Ministry/ Department of the Government of India is empowered, after due consideration, to waive the requirement of registration for a particular item/ application or a class of items/ applications from the requirement of registration, even if included in Schedule III. The Ministry/ Department concerned shall intimate the Department for Promotion of Industry and Internal Trade (DPIIT) and National Security Council Secretariat (NSCS) of their decision to waive the requirement of registration. Ministries/ Departments of the Government of India are not required to consult the DPIIT/ NSCS before deciding and are only required to intimate the decision to DPIIT/ NSCS. If any point is raised by DPIIT/ NSCS, it should be considered in future procurements; ongoing procurement for which the waiver was granted need not be interrupted or altered.

16. Based on security considerations, a Ministry/ Department in a Category II sensitive sector or other Ministries/ Departments may recommend to DPIIT inclusion of any other technology in the list of sensitive technologies, either generally or for their Ministry/ Department.

Sub-contracting in works contracts

17. In works contracts, including turnkey contracts, contractors shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority. The definition of "contractor from a country which shares a land border with India" shall be as in paragraph 12 above. This shall not apply to sub-contracts already awarded on or before 23.07.2020.

[Note: Procurement of raw material, components, etc. does not constitute sub-contracting.]

Certificate regarding compliance

18. An undertaking shall be taken from bidders in the tender documents (**Annexure III**) that the extant guidelines for participation in the tenders (which should include conditions for implementation of this Order) have been complied with. If such certificate given by a bidder whose bid is accepted is found to be false, this would be a ground for debarment and further legal action in accordance with law.

Validity of registration


19. In respect of tenders, registration should be valid at the time of submission of bids and at the time of acceptance of bids. In respect of supply otherwise than by tender, registration should be valid at the time of placement of order. If the bidder was validly registered at the time of acceptance / placement of order, registration shall not be a relevant consideration during contract execution.

Government e-Marketplace (GeM)

20. GeM shall remove non-compliant entities from GeM unless/ until they are registered in accordance with this Order.

Model Clauses/ Certificates

21. Model Clauses and Model Certificates which may be inserted in tenders/ obtained from Bidders are given at Annexure-III. While adhering to the substance of the Order, procuring entities are free to appropriately modify the wording of these clauses based on their past experience, local needs etc.


23/02/2023
(Kanwalpreet)
Director(PPD)

Tel.No. 2309 3811; email: kanwal.irss@gov.in

To

1. Secretaries of all Ministries/ Departments of Government of India for information and necessary action. They are also requested to inform these provisions to all procuring entities.
2. Secretary, Department of Public Enterprises with a request to immediately reiterate these orders in respect to public enterprises.
3. Secretary, Department of Financial Services with a request to immediately reiterate these orders in respect to public sector and public sector financial institutions.
4. Secretary DPIIT with a request to take action as provided under Annexure I.
5. Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi.
6. CEO/ GeM with a request to ensure implementation of this order on GeM.

List of Category-I Sensitive sectors:

Sr.No.	Sector
(i)	Atomic Energy
(ii)	Broadcasting/ Print and Digital Media
(iii)	Defence
(iv)	Space
(v)	Telecommunications

List of Category-II Sensitive sectors:

Sr.No.	Sector
(i)	Power and Energy (including exploration/ generation/ transmission/ distribution/ pipeline)
(ii)	Banking and Finance including Insurance
(iii)	Civil Aviation
(iv)	Construction of ports and dams & river valley projects
(v)	Electronics and Microelectronics
(vi)	Meteorology and Ocean Observation
(vii)	Mining and extraction (including deep sea projects)
(viii)	Railways
(ix)	Pharmaceuticals & Medical Devices
(x)	Agriculture
(xi)	Health
(xii)	Urban Transportation

List of Sensitive Technologies:

Sr.No.	Sensitive Technologies
(i)	Additive Manufacturing (e.g. 3D Printing)
(ii)	Any equipment having electronic programmable components or autonomous systems (e.g. SCADA systems)
(iii)	Any technology used for uploading and streaming of data including broadcasting, satellite communication etc.
(iv)	Chemical Technologies
(v)	Biotechnologies including Genetic Engineering and Biological Technologies
(vi)	Information and Communication Technologies
(vii)	Software

Competent Authority and Procedure for Registration

- A. The Competent Authority for the purpose of registration under this order shall be/ continue to be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT)*. [This Committee was already constituted under Order (Public Procurement) No.1].
- B. The Registration Committee shall have the following members*:
- i. An officer, not below the rank of Joint Secretary, designated for this purpose by DPIIT, who shall be the Chairman;
 - ii. Officers (ordinarily not below the rank of Joint Secretary) representing the Ministry of Home Affairs, Ministry of External Affairs, and of those Departments whose sectors are covered by applications under consideration;
 - iii. Any other officer whose presence is deemed necessary by the Chairman of the Committee.
 - iv. With effect from 01.04.2023, an officer (ordinarily not below the rank of Joint Secretary) representing the National Security Council Secretariat.
- C. DPIIT shall lay down the method of application, format etc. for such bidders as covered by the Order.
- D. On receipt of an application seeking registration from a bidder covered by Para 2 and 3 of this order, the Competent Authority shall first seek political and security clearances from the Ministry of External Affairs and Ministry of Home Affairs, as per guidelines issued from time to time. Registration shall not be given unless political and security clearance have both been received.
- E. The Ministry of External Affairs and Ministry of Home Affairs may issue guidelines for internal use regarding the procedure for scrutiny of such applications by them.
- F. The decision of the Competent Authority, to register such bidder may be for all kinds of tenders or for a specified type(s) of goods or services, and may be for a specified or unspecified duration of time, as deemed fit. The decision of the Competent Authority shall be final.
- G. Registration granted by the Competent Authority of the Government of India shall be valid not only for procurement by the Central Government and its bodies specified in para 6 of this order, but also for procurement by State Governments and their agencies/ public enterprises etc. No fresh registration at the State level shall be required.
- H. The Competent Authority is empowered to cancel the registration already granted if it determines that there is sufficient cause. Such cancellation by itself, however, will

not affect the execution of contracts already awarded. Pending cancellation, it may also suspend the registration of a bidder, and the bidder shall not be eligible to bid in any further tenders during the period of suspension.

- I. For national security reasons, the Competent Authority shall not be required to give reasons for rejection/cancellation of registration of a bidder.

[*Note:

(i) In respect of application of the Order to procurement by/ under State Governments, all functions assigned to DPIIT shall be carried out by the State Government concerned through a specific department or authority designated by it. The composition of the Registration Committee shall be as decided by the State Government. However, the requirement of political and security clearance as per para D shall remain and no registration shall be granted without such clearance.

(ii) Registration granted by State Governments shall be valid only for procurement by the State Government and its agencies/ public enterprises etc. and shall not be valid for procurement in other states or by the Government of India and their agencies/ public enterprises etc.]

Special Cases

- A. In projects which receive international funding with the approval of the Department of Economic Affairs (DEA), Ministry of Finance, the procurement guidelines applicable to the project shall normally be followed, notwithstanding anything contained in this order and without reference to the Competent Authority. Exceptions to this shall be decided in consultation with DEA.
- B. This order shall not apply to procurement by Indian missions and by offices of government agencies/ undertakings located outside India.
- C. This order will not apply to bidders (or entities) from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects. Updated lists of countries to which lines of credit have been extended or in which development projects are undertaken are given on the website of the Ministry of External Affairs.
- D. Procurement of spare parts and other essential service support like Annual Maintenance Contract (AMC)/ Comprehensive Maintenance Contract (CMC), including consumables for closed systems, from Original Equipment Manufacturers (OEMs) or their authorized agents, shall be exempted from the requirement of registration.

Model Clause/ Certificate/ Undertaking to be inserted in tenders etc.

[While adhering to the substance of the Order, procuring entities and GeM are free to appropriately modify the wording of the clause/ certificate based on their past experience, local needs etc.

The conditions relating to specified ToT (as shown in italics) should be incorporated only in the tenders which attract the restrictions due to specified ToT.]

A. Model Clauses for Tenders (including tenders issued manually or any electronic portal including GeM):

I. Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with the Competent Authority. *Further, any bidder (including bidder from India) having specified Transfer of Technology (ToT) arrangement with an entity from a country which shares a land border with India, shall also require to be registered with the same competent authority.*

II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.

III. "Bidder (or entity) from a country which shares a land border with India" for the purpose of this Order means: -

- (a) An entity incorporated, established or registered in such a country; or
- (b) A subsidiary of an entity incorporated, established or registered in such a country; or
- (c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
- (d) An entity whose beneficial owner is situated in such a country; or
- (e) An Indian (or other) agent of such an entity; or
- (f) A natural person who is a citizen of such a country; or
- (g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The beneficial owner for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

Explanation—

a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent. of shares or capital or profits of the company;

b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.

VI. [To be inserted in tenders for Works contracts, including Turnkey contracts] The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority.

VII. The registration shall be valid at the time of submission of bid and at the time of acceptance of bid.

VIII. If the bidder was validly registered at the time of acceptance / placement of order, registration shall not be a relevant consideration during contract execution

Model Certificate for Tenders:

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Model Certificate for Tenders for Works involving possibility of sub-contracting:

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any

work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Model additional certificate by Bidders in the cases of specified ToT:

"I have read the clause regarding restrictions on procurement from a bidder having Transfer of Technology (ToT) arrangement. I certify that this bidder does not have any ToT arrangement requiring registration with the competent authority."

OR

"I have read the clause regarding restrictions on procurement from a bidder having Transfer of Technology (ToT) arrangement. I certify that this bidder has valid registration to participate in this procurement."

B. Model Certificate for GeM (to be taken by the GeM from seller during registration on GeM. GeM should also obtain this certificate from all existing bidders as soon as possible):

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this vendor/ bidder is not from such a country and does not have any specified Transfer of Technology (ToT) from such a country or, if from such a country or if having specified ToT from such a country has been registered with the Competent Authority. I hereby certify that this vendor/ bidder fulfills all requirements in this regard and is eligible to be considered for procurement on GeM. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

ANNEXURE-V TO SCC

NOT USED

F. No. 11/22/2021-Th.II
Government of India
(Bharat Sarkar)
Ministry of Power
(Vidyut Mantralay)

Shram Shakti Bhawan, Rafi Marg
New Delhi, the 22nd March, 2022

OFFICE MEMORANDUM

Subject: Constitution of Conciliation Committee of Independent Experts for resolution of contractual disputes in respect of the projects implemented by CPSUs / Statutory Bodies under administrative control of Ministry of Power – regarding.

With the approval of Hon'ble Minister of Power and New & Renewable Energy, Ministry of Power, vide OM of even number dated 29.12.2021 (**Annex-I**), introduced a conciliation mechanism for settlement of contractual disputes in contracts of CPSUs / Statutory Bodies under Ministry of Power executing power projects. For this purpose, it was decided to constitute three numbers of Conciliation Committees of Independent Experts (CCIEs).

2. Accordingly, a Notification of even number was issued on 07.01.2022 inviting Expression of Interest from the eligible candidates for empanelment as Independent Expert for constitution of the CCIEs. Consequently, with the approval of Hon'ble Minister of Power, a Search-cum-Selection Committee was also constituted for scrutiny of the EoIs as well as screening of the candidates.

3. Based on the recommendations of the Search-cum-Selection Committee, following three nos. of Conciliation Committee of Independent Experts are hereby constituted for settlement of contractual disputes in contracts of CPSUs / Statutory Bodies under Ministry of Power executing power projects:-

CCIE	Members of CCIE
CCIE-1	Shri Anup Wadhawan, Ex-Secretary (Commerce), GoI
	*Shri Ravinder Kumar Sharma, Ex-MD, HBSEBL
	Shri Mrinal Kanti Bhattacharya, Ex-Executive Director, Indian Bank
CCIE-2	Ms. Rashmi Verma, Ex-Secretary (Tourism), GoI
	*Shri Dharendra Veer Singh, Ex-CMD, THDC (India) Ltd.
	Shri Naveen Bhushan Gupta, Ex-Director (Finance), PFC Ltd.
CCIE-3	Shri P. S. Kharola, Ex-Secretary (Civil Aviation), GoI
	*Shri Anil Kumar Jha, Ex-Director (Technical), NTPC Ltd.
	Shri Chinmaya Gangopadhyaya, Ex-Director (Projects), PFC Ltd.

4. The aforementioned CCIEs shall function as per the Standard Operating Procedure enumerated in this Ministry's Office Memorandum of even number dated 29.12.2021. Moreover, the tenure, remuneration and other terms and conditions of the engagement of above Members of CCIEs shall also be governed by the aforesaid OM.

This issues with the approval of Hon'ble Minister of Power and New & Renewable Energy.

Encl: as above.

Vikrant S. Dhillon

(Vikrant S. Dhillon)
Deputy Director

Email: hydro2-mop@gov.in

***Second member in the CCIE(s) shall stand substituted by coal-mining expert Member (presently, Shri Tapas Kumar Nag, Ex-CMD, NCL), as notified by Ministry of Power from time to time, in case of disputes relating to captive coal mines**

To

1. Chairperson, CEA
2. CMDs – PGCIL, REC, PFC, NTPC, NHPC, SJVN, THDC, NEEPCO, POSOCO
3. Chairman - BBMB, DVC
4. Director General – BEE, NPTI, CPRI

Copy to:

1. PS to Hon'ble Minister of Power & NRE
2. APS to Hon'ble MoS for Power
3. Sr. PPS to Secretary (Power)
4. Sr. PPS to AS(SKG) / Sr. PPS to AS&FA / Sr. PPS to AS(VKD)
5. All Joint Secretaries of Ministry of Power
6. All Directors / Deputy Secretaries of Ministry of Power.
7. Members of the CCIEs

Copy also to:

In-charge, NIC Cell, MoP with request to publish the OM on the website of Ministry of Power.



(Vikrant S. Dhillon)
Deputy Director

ANDAMAN & NICOBAR GAS POWER PROJECT (50MW)

TECHNICAL SPECIFICATION

SECTION – VI

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PART-A
VOLUME - I
INTENT OF SPECIFICATION

INTENT OF SPECIFICATION

1.00.00 INTENT OF SPECIFICATION

1.01.00 Scope of the Proposal

The scope of the proposal for Engineering, Supply, Erection, Testing & Commissioning works for Andaman & Nicobar Gas Power Project (50 MW \pm 10%) shall be on the basis of a single point responsibility, completely covering the following activities and services in respect of all the equipment specified and covered under the specifications and read in conjunction with "Scope of Supply & Services", Volume-III, Part-A, Section –VI of Technical Specification.

- i) Basic Engineering of the plant including preparation of plant design manuals for the power project.
- ii) Detailed design of all the equipment and system(s) including grouting of the equipment and fixing supports in wall, structure steel works included in bidder's scope for the Project.
- iii) Providing engineering drawings, equipment sizing & performance data, instruction manuals, as built drawings, O&M manuals and other information for Employer's approval.
- iv) Compliance with statutory requirements and obtaining clearances from statutory authorities, wherever required.
- v) Complete manufacturing including shop testing/type testing.
- vi) Complete structural work related to all equipment erection as per scope of this package in Part A, Volume III, providing construction offices, field laboratory, construction equipment, construction power and construction water.
- vii) Packing and transportation from the manufacturer's work to the site including customs clearance/port clearance, port charges, if any.
- viii) Receipt, storage, preservation and conservation of equipment at the site.
- ix) Fabrication, pre-assembly, if any, erection, testing and putting into satisfactory operation all the equipment including successful completion of facilities.
- x) Reliability tests and owner acceptance including the tests for performance demonstration after successful completion of facilities.
- xi) Furnishing of spares on FOR (Freight on Road) site basis.
- xii) Reconciliation with customs authorities, in case of foreign bidders.
- xiii) Satisfactory conclusion of the Contract.
- xiv) Insurance and other requirements for the complete Power plant package in accordance with the provisions of general conditions of contract (Section-IV) of the bidding document.
- xv) One year supervision during operation and maintenance with deputation of 1 operation and 1 maintenance expert post successful completion of initial/trial operations & Performance guarantee tests including Demonstration tests (whichever occurs later).

The Power plant is expected to run for its life on RLNG as fuel for the project.

1.02.00 The Bidder shall be responsible for providing all material, equipment and services, specified or otherwise which are required to complete the project and fulfill the intent of ensuring operability, maintainability and reliability of the complete work covered under this specification. It is not the intent to specify completely herein, all aspects of design and construction; nevertheless, the equipment and works shall conform in all respects

CONTENT OF SPECIFICATION

to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to Employer, who will interpret the meaning of the specification, drawings, operation of equipment, maintenance redundancy etc. and shall have a right to reject or accept any work or material which in his assessment is not complete to meet the requirements of this specification and/or applicable National and International standards mentioned elsewhere in the specification or otherwise.

1.02.01

Bidder is requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should be within the time period as stipulated in ITB. The Bidder's offer should not carry any sections like clarifications, interpretations and/or assumptions. In the event of conflict between the Technical Specifications and the Conditions of Contract, the requirements as indicated in the technical specification shall govern, unless confirmed otherwise by the Employer in writing before the award of this contract, based on a written request from the Bidder for such a clarification. However, if the Bidder feels that, in his opinion, certain features brought out in his offer are superior to what has been specified, these may be highlighted separately.

PART-A
VOLUME – II
PROJECT INFORMATION

1.01.00 Introduction

1.01.01 NVVN, New Delhi is planning to setup a power plant of approx. 50 MW capacity at Hope Town, Port Blair, Andaman & Nicobar Islands. Re-gasified Liquefied Natural Gas (RLNG) shall be the fuel for the project.

1.01.02 Power generation shall be with RLNG fired engine sets. The Net Capacity of Plant shall be 50 MW± 10% (45 MW to 55 MW) with 4 to 11 nos. of identical units.

1.01.03 Further to the information given in the following paragraphs, bidders are advised to visit the project site and collect data on local conditions as required for making a comprehensive and fully compliant bid in accordance with the requirements of various sections of bid documents including Technical Specifications.

1.02.00 Site Location

1.02.01 The project site is located in Hope Town at Ferrargunj Tehsil in South Andaman District of Andaman & Nicobar Islands. Nearest National Highway NH-223 is at a distance of 8 km in North direction. Nearest major city is Port Blair located at a distance of 7.9 km south to the project site.

The Site is located at latitudes of 11° 41' 43" N and longitudes of 92° 43' 40"E respectively.

1.03.00 Approach to Site

The site can be approached from coastal road linking Bamboo Flat & Hope Town and through water ways. The nearest airport is Veer Savarkar International Airport, Port Blair at a distance of about 4.5 Km from project site.

1.03.01 Airport

Nearest commercial Airport	Veer Savarkar International Airport	About 4.5 Km
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1.03.02 Sea Ports

Nearest Commercial Port Govt. of India has notified 23 ports in the Andaman & Nicobar Islands. However, the Main Shipping activities are carried out at Port Blair. Eight ports are in other islands viz. Diglipur, Mayabunder, Rangat, Hut Bay, Car Nicobar, Katchal & Campbell Bay and these ports are notified as Wharfage ports.

Ports	Chennai Port	About 1350 Km
	Vishakhapatnam Port	About 1200 Km
	Kolkata Port	About 1255 Km

1.04.00 Land Availability

Proposed site at Hope Town, about 2 Acres of polygon shaped waste and barren land (Survey No - 41) having irregular topography exists along the seashore. The Site having elevation varying from 4m to 12m above MSL is flanked between Sea on front side & stiff rock Hill on backside. The power project is proposed to be accommodated within the

available land (approx. 2 Acres) located in Hope Town. For further details tentative General Layout Plan (GLP) attached with Technical Specification may be referred.

1.05.00 Fuel

Fuels envisaged for the proposed power plant is RLNG.

1.05.01 RLNG

Employer shall make RLNG available at a terminal point within plant premises. Expected composition of RLNG shall be as indicated at Annexure-IA, Volume-II, Part-A of 'Project Information'. Further, bidder shall make arrangements for suitability of RLNG pressure as per requirement of the offered Engines.

1.06.00 Water Availability

1.06.01 Source

The Makeup water requirements for the project will be drawn from Sea, by Sea water Intake Pumps.

Provision of Rainwater harvesting shall also be kept for the plant for collection of rain water to be used for make-up.

1.06.02 Quality of Raw Water

Expected quality of Sea water to be supplied to the Plant shall be as indicated at Annexure – II of 'Project Information'. However, Bidder to perform analysis for determination of actual sea water quality.

1.07.00 Meteorological Data

1.07.01

Climatological data for the nearest observatory at Port Blair as published by the Meteorological Department, Government of India shall be as per Annexure – III of 'Project Information'.

1.08.00 Wind Design Criteria

Criteria for Wind resistant design of structures and equipment shall be as per Annexure-IVA & IVB.

1.09.00 Earthquake Design Criteria

Criteria for earthquake resistant design of structures and equipment shall be as per Annexure-V.

EXPECTED SPECIFICATION OF RLNG

	Particulars	Unit	Minimum	Maximum	Typical
1.	COMPOSITION				
	a. Methane (C1)	% Molar	88.0	98.5	93.0
	b. Ethane (C2)	% Molar	1.5	6.0	3.35
	c. Propane (C3)	% Molar	-	3.5	1.75
	d. Butane (C4)	% Molar	-	2.0	1.0
	e. Pentane (C5) & heavier	% Molar	-	0.1	0.1
	f. Nitrogen	% Molar	-	1.0	0.8
2.	Gross Heating Value	Kcal/standard m ³	8994	10508	-
3.	Pressure	Bar (g)	8	10	-
4.	Temperature	Degree C	25	35	-
5.	Moisture	Kg/Million SM3		112	
6.	Impurities				
	a. Carbon dioxide	ppm – mole	-	100	
	b. Oxygen	ppm – mole	-	50	
	c. Hydrogen Sulphide	mg/Nm3	-	5	
	d. Mercaptan Sulphur	mg/Nm3		7	
	e. Total Sulphur (including mercaptans)	mg/Nm3		30	
6.	CONTAMINANTS				
	Trace Metals				
	i. Pb + Zn	ppm (wt)	-	0.50	
	ii. Na + K	ppm (wt)	-	0.30	
	iii. Vanadium	ppm (wt)	-	0.50	
	iv. Calcium	ppm (wt)	-	2.0	
	v. Magnesium	ppm (wt)	-	2.0	
	vi. Sum of heavy metals	ppm (wt)	-	1.0	

Note: Typical composition has been given only as a reference condition for Performance Guarantee (refer clause 3.01.00, Volume – IV). Actual composition of the gas generally may be anything within the range indicated. **However, the engine shall also be designed to run on gas fuel with methane no. lowest upto 65.**

INDICATIVE SEA WATER ANALYSIS OF WATER FOR A & N GAS POWER PROJECT

Sl. No.	Parameter	IMW3 Hope Town Wharf
i	Latitude-Longitude	11°41'49.94"N 92°43'25.66"E
ii	Sampling Period, hrs.	07:45-08:00
1	pH	8.08
2	Colour, Hazen Units	No noticeable color
3	Odour (as perceived)	No offensive odour
4	Floating Materials	No Visible Solids
5	Temperature, °C	27.5
6	Salinity, ppt (Surface)	31.2
7	Turbidity, NTU	1.0
8	Dissolved Oxygen (min.), mg/l	5.6
9	Total Suspended Solids, mg/l	18
10	Electrical Conductivity, umhos/cm	46000
11	Total Dissolved Solids, mg/l	34500
12	Total Hardness (as CaCO ₃), mg/l	6300
13	Calcium Hardness (CaCO ₃), mg/l	2100
14	Magnesium Hardness (CaCO ₃), mg/l	4200
15	Calcium (as Ca), mg/l	840
16	Magnesium (as Mg), mg/l	1008
17	Sodium (as Na), mg/l	9300
18	Potassium (as K), mg/l	240
19	Chlorides (as Cl), mg/l	19200
20	Sulphates (as SO ₄), mg/l	2050
21	Total Alkalinity (as CaCO ₃), mg/l	120
22	BOD-3 days, 27°C, mg/l	2
23	COD, mg/l	70
24	Oil & Grease, mg/l	Nil
25	Fluorides (as F), mg/l	0.91
26	Nitrates (as NO ₃), mg/l	0.18
27	Phosphates (as PO ₄), mg/l	0.24
28	Free Ammonia (as N), mg/l	0.08
29	Nitrites (as NO ₂), mg/l	0.21
30	Chlorinated Hydrocarbons (as Cl), mg/l	Nil
31	Phenols (as C ₆ H ₅ OH), mg/l	Nil
32	Iron (as Fe), mg/l	0.12
33	Manganese (as Mn), mg/l	0.02
34	Copper (as Cu), mg/l	0.01
35	Zinc (as Zn), mg/l	0.02
36	Mercury (as Hg), mg/l	<0.0001
37	Cadmium (as Cd), mg/l	<0.01
38	Chromium (as Cr ⁶⁺), mg/l	<0.01
39	Lead (as Pb), mg/l	<0.01
40	Arsenic (as As), mg/l	<0.01
41	Percent Sodium, %	75.4
42	Total Coliforms, MPN/100 ml	40
43	Phytoplanktons, Nos./l	2400
44	Zooplanktons, Nos./cu.m	5700

CLIMATOLOGICAL DATA

STATION : Point Bish		STATION LAT		STATION LONG		STATION ALTITUDE		STATION NAME		STATION TYPE		STATION DATE		STATION SOURCE															
		11°43'		92°43'		1000		Point Bish		Weather		1971-2008		Based on Observations															
MONTH	STATION PREVIOUS	MEAN												EXTREME		HUMIDITY		CLOUDS		WIND		PRECIPITATION		SUNSHINE		FROST		WIND VELOCITY	
		DRY BULB	WET BULB	DEW POINT	RELATIVE HUMIDITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY	HIGHEST WIND VELOCITY	LOWEST WIND VELOCITY		
Jan	10004.9	26.9	23.2	20.3	21.6	30.5	18.1	32.7	31	14.0	19.7	29	72	23.0	4.2	2.4	37.2	1.8	503.7	0.0	208.3	22	6.6	1922	1922	1922	22	6.6	
Feb	10004.5	26.9	22.7	20.1	21.3	31.4	18.4	34.6	1	15.0	11	11	71	25.0	3.5	2.0	18.5	1.2	234.9	0.0	131.1	7	6.3	1923	1923	1923	7	6.3	
Mar	10003.7	28.4	24.3	21.2	22.1	33.0	18.5	36.2	26	16.2	10	10	69	27.0	3.6	2.1	12.8	1.1	206.3	0.0	96.1	27	4.7	1924	1924	1924	27	4.7	
Apr	10002.2	29.9	24.6	22.2	23.6	34.8	21.7	38.1	28	17.1	12	12	68	29.4	4.5	2.9	80.2	3.5	448.8	0.0	306.8	20	5.2	1925	1925	1925	20	5.2	
May	10001.1	28.8	24.0	21.1	23.7	33.2	21.4	36.1	8	17.1	28	28	74	28.1	4.1	2.9	40.2	3.5	191.0	0.0	306.8	20	5.2	1926	1926	1926	20	5.2	
Jun	10000.9	27.3	23.2	20.6	23.5	31.1	20.4	35.6	16	14.6	6	6	81	30.4	5.9	4.5	139.3	15.7	1080.8	62.0	304.8	31	10.1	1927	1927	1927	31	10.1	
Jul	10001.3	26.8	24.9	21.0	23.3	30.6	21.0	32.8	20	18.0	20	20	83	30.3	6.1	3.9	45.7	18.9	1054.1	134.7	280.3	1	16.8	1928	1928	1928	1	16.8	
Aug	10001.2	27.2	25.1	20.1	23.2	30.4	20.8	31.7	18	17.4	7	7	84	30.2	6.9	4.3	45.6	18.7	925.9	27.1	204.2	15	15.1	1929	1929	1929	15	15.1	
Sep	10001.2	26.2	24.5	20.2	22.7	30.6	20.0	36.4	2	16.0	7	7	83	30.0	6.5	4.1	45.6	18.1	924.8	72.9	173.7	13	16.4	1930	1930	1930	13	16.4	
Oct	10002.4	26.3	24.5	20.6	22.6	31.0	21.0	36.6	23	17.0	27	27	80	28.0	5.9	3.7	30.5	15.9	513.9	82.3	103.2	11	7.1	1931	1931	1931	11	7.1	
Nov	10000.8	27.7	24.0	20.5	22.8	30.9	20.0	32.3	8	17.3	22	22	78	28.2	5.6	3.7	240.4	12.0	648.7	13.9	147.3	9	7.1	1932	1932	1932	9	7.1	
Dec	10002.2	26.2	23.1	20.3	22.8	30.4	18.2	32.6	19	16.2	11	11	79	26.6	4.9	3.1	124.9	4.4	705.7	0.0	374.3	31	7.6	1933	1933	1933	31	7.6	
ANNUAL TOTAL OR MEAN	10002.1	27.6	24.7	20.9	22.8	30.9	17.4	36.1	28	14.0	9	9	77	28.8	5.6	3.4	281.5	130.6	4370.4	157.2	374.3	31	8.4	1934	1934	1934	31	8.4	
MEAN	998.5	26.9	24.3					4	18.99	6	18.99		80	28.3	5.8	3.3			1864	107.9	12	1976							

संरचनात्मक सारणी
CLIMATOLOGICAL TABLE

स्टेशन : पोर्टब्लेअर
STATION : Port Blair

मास Month	संरचनात्मक												वर्षा												शुष्क												समुद्र											
	संरचनात्मक						वर्षा						शुष्क						समुद्र						संरचनात्मक						वर्षा						शुष्क						समुद्र					
	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र	संरचनात्मक	वर्षा	शुष्क	समुद्र																
JAN	27	0.0	0.2	1.1	0.0	0.0	0.0	0	1	26	3	17	84	17	1	0	0	0	0	0	0	0	0	0	0	5	18	8	1	2	16	12	1	0	0	0	0	0.0	0.7	129	158	17						
FEB	16	0.0	0.6	3.7	0.0	0.0	0.0	0	0	24	4	17	48	16	2	0	0	0	0	0	0	0	0	0	0	8	14	5	0	5	12	10	1	0	0	0	0.0	0.8	115	146	11							
MAR	17	0.0	1.8	4.3	0.0	0.0	0.0	0	0	24	7	14	35	17	3	1	1	2	3	6	21	1	9	16	6	0	0	0	0	4	15	12	0	0	0	0	0.0	0.6	116	181	0.7							
APR	57	0.0	7.5	0.7	0.0	0.1	0.1	0	0	25	5	9	24	19	5	3	3	10	9	18	0	4	16	9	0	0	0	0	0	1	10	18	1	0	0	0	0.0	0.3	92	189	1.6							
MAY	196	0.0	13.1	0.3	0.0	0.5	0.5	0	3	21	7	3	5	7	5	10	28	19	7	16	0	1	9	15	0	0	0	0	0	0	7	16	8	0	0	0	0.0	0.7	147	142	0.4							
JUN	242	0.0	7.7	0.1	0.0	1.8	1.8	0	12	17	1	0	0	1	2	11	61	19	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	2.2	178	9.7	0.2								
JUL	249	0.0	7.5	0.2	0.0	2.2	2.2	0	8	20	3	0	0	0	0	1	12	50	18	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	2.4	194	8.0	0.1									
AUG	250	0.0	5.8	0.4	0.0	1.9	1.9	0	11	18	2	0	0	0	0	1	10	58	22	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	2.0	179	10.9	0.2									
SEP	232	0.0	4.6	2.5	0.0	0.9	0.9	0	6	20	4	0	0	0	0	1	8	61	20	3	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	2.8	19.5	8.1	0.1									
OCT	201	0.0	5.8	4.3	0.0	0.3	0.3	0	2	21	8	3	12	13	7	4	7	38	25	7	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	1.7	15.9	12.1	0.3									
NOV	164	0.0	4.2	2.3	0.0	0.2	0.2	0	1	16	2	0	0	0	0	1	10	58	22	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	-1.0	14.8	13.5	1.6									
DEC	69	0.0	1.1	0.8	0.0	0.1	0.1	0	2	27	3	5	27	24	9	4	3	2	2	26	0	1	10	14	5	0	0	0	0	0	0	0	0	0	0.0	1.1	13.6	14.3	1.0									
ANNUAL TOTAL OR MEAN	172.0	0.0	59.8	20.6	0.0	8.0	8.0	0	53	254	48	5	21	12	4	6	23	11	4	13	2	35	115	156	57	13	85	242	25	0	0	0	0.0	14.2	174.3	165.3	11.2											
NUMBER OF YEARS	30							30	36	248	81	3	19	11	3	5	23	10	4	22	1	23	110	159	72	9	100	228	28	0	0	0.1	21.5	225.8	115.9	1.8												

A & N GAS POWER PROJECT

CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See Annexure - IVB for site specific information.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than "5" and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovaling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875 (Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

- | | | |
|-----------------------------------|---|--|
| a) Welded steel structures | : | 1.0% |
| b) Bolted steel structures | : | 2.0% |
| c) Reinforced concrete structures | : | 1.6% |
| d) Steel-stacks | : | As per IS: 6533 & CICIND Model Code, whichever is more critical. |

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

- | | | |
|----|--|-------------------|
| a. | The basic wind speed " V_b " at ten metres above the mean ground level | 44 metres/ second |
| b. | The risk coefficient "K1" | 1.07 |
| c. | The risk coefficient "K4" | 1.15 |
| d. | Category of terrain | Category-1 |

Note: Notwithstanding the values of the above mentioned parameters, the design wind pressure so computed at any point shall not be taken less than 1500 N/M² for all classes of structures, i.e. A, B & C, as defined in IS: 875 (Part-3).

ANDAMAN & NICOBAR GAS POWER PROJECT**CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT**

All structures and equipment shall be designed for seismic forces using the other provisions in accordance with IS:1893 (Part 1):2002 and IS:1893 (Part 4):2005. Pending finalisation of Parts 2, 3 and 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings and industrial structures including stack-like structures.

Site falls in Seismic zone V.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

a)	Steel structures	:	2%
b)	Reinforced Concrete structures	:	5%
c)	Reinforced Concrete Stacks	:	3%
d)	Steel stacks	:	2%

PART-A
VOLUME - III

**SCOPE OF SUPPLY & SERVICES, TERMINAL
POINTS AND EXCLUSIONS**

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

1.00.00 GENERAL

- 1.01.00 Scope of Work in respect of equipment and systems mentioned herewith shall be in accordance with the provisions of various sections of Technical Specifications and such as to deliver a fully operational plant that meets the Intent of the Specification.
- 1.02.00 The Scope of Work shall include Planning, Design, Engineering, Manufacture, Fabrication, Assembly, Pre-shipment Testing at manufacturer's works, Packing, Transportation, Handling, Delivery at Plant Site, Storage, Installation, Interconnection with related plant and equipment, Pre-Commissioning, Commissioning, Initial Operation, Conductance of Acceptance Tests and subsequent One year supervision during operation and maintenance with deputation of 1 operation and 1 maintenance expert post successful completion of initial/trial operations & Performance guarantee tests including Demonstration tests (whichever occurs later).
- 1.03.00 This Volume describes only the brief scope for Supplies and Services. However, the Scope includes all such material, equipment and services which may not be specifically stated in the specifications but required for completeness of the equipment/ systems for meeting the Intent of Specification and Specification requirements. The work shall be consistent with modern practices and shall comply with all applicable codes, standards, guidelines and safety requirements in force as on the date of award of the contract.
- 1.04.00 The bidders are requested to submit their offer with best ratings and specifications. Ratings of any items, equipment or auxiliaries, building space, that are not asked to be specified in the technical proposals shall be decided at the time of according to approval to design basis reports, drawings and specifications, during project execution. The bidder shall be presumed to have considered all items and its' ratings in his supply scope in his bid. Increase of price on account of difference in any items and its' ratings between those estimated by the bidder and those approved by the Employer shall not be allowed whatsoever.
- 1.05.00 In the event of conflict between requirements of any two clauses of specification, Employer's discretion shall apply unless otherwise confirmed by the Employer in writing before the award of the contract, based on a written request from the Contractor.
- 1.06.00 Contractor shall provide all equipment, devices and systems on as required basis subject to the minimum quantities indicated in the following clauses.

2.00.00 ENGINE GENERATOR SETS AND AUXILIARIES

- 2.01.00 The net capacity of Plant shall be of 50MW \pm 10% (45 MW to 55 MW) with 4 to 11 nos. of identical units.
- 2.02.00 Each Engine-Generator set (Genset) shall necessarily include but not be limited to the following:

i. All Stationary and Rotating Components of Engine

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

- ii. Rotor Support System (Bearings etc.) and all interconnecting couplings
- iii. Engine Exhaust system
- iv. AC Generator along with excitation system
- v. Foundation Bolts, Base Plate and Support Structures
- vi. Any other component/system as per the standard proven practice and as required for the Genset model offered.

2.03.00 **Integral Auxiliaries and Support Systems for each Genset**

Integral Auxiliaries for Genset shall necessarily include the following:

- i. Lube Oil System complete with Pumps, Filters, Coolers, oil purifying system, Valves and Piping.
- ii. Turbocharging system
- iii. Governing System
- iv. Protective Devices
- v. Combustion system
- vi. Gaseous-Fuel Supply and Metering System complete with Filter, Piping, Stop/ Control Valves and Distribution Headers etc.
- vii. Startup system including Start up Air compressor & Air Bottles/ Motorised Start up system as per standard practice of OEM.
- viii. Turning Gear system
- ix. Engine Cooling Water systems
- x. Gas leakage Detection system
- xi. Air Intake System
- xii. Equipment Cooling water system complete with all required piping and valves
- xiii. 2no. of EOT crane as per IS 3177 (Common for all the engines) . Each crane capable of lifting 105% of the single heaviest equipment/components (Except Gas Engines) including lifting beam and slings etc. (as applicable) for maintenance and loading/unloading in the engine hall. However, min. 5 Tons capacity EOT cranes each to be provided.
- xiv. Waste liquid collection and disposal system
- xv. Common or Unitized NOx control system as per standard proven practise of the engine OEM
- xvi. Any other system required for continuous and trouble free operation of Engines in all the specified operating regimes and ambient conditions.

2.04.00 Equipment and systems mentioned above shall be in accordance with the specification requirements of Part B and relevant clauses of Part A of Section VI of Technical Specification.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

3.00.00 GAS ENGINE EXHAUST SYSTEM

3.01.00 Gas Engine Exhaust System

Complete ducting system from the gas engine outlet to the Chimney. This will include Exhaust gas silencers, Expansion bellows, Rupture Discs, Exhaust Duct insulation and Supports etc.

Provision of blind flange with proper sealing to be kept in the Exhaust lines of Engines to facilitate installation of future Heat Recovery system.

3.02.00 Valves/Gates/Dampers

All necessary isolating, regulating, check and relief valves, gates and dampers etc.

3.03.00 Steel Stack

- i. Stack suitable to discharge flue gases at height of "H" meters (calculated as $H = 14XQ^{0.3}$, where Q = SO₂ emission in Kg/hour) from the finished grade level and complying CPCB and MoEF&CC norms subject to minimum height of 30 meters.
- ii. Each stack shall be provided with complete supporting structure.
- iii. Each stack shall be provided with continuous online NO_x, SO₂ & CO analyzer equipment. Suitable approach and platform for these shall also be provided. NO_x, SO₂ and CO values shall be made available in CCR through required instrumentation.

4.00.00 Supporting Steel Works

- i. All supporting steel works for Gensets and its auxiliaries.
- ii. Necessary structural steel for stack, Dampers, ducting roof, weather canopies and the platforms at the sides of the Gensets and in other areas.

5.00.00 All Galleries, walkways and Platforms

These shall comply with all safety requirements as detailed in Volume – IV (Part A, Section VI) and relevant equipment specifications (Part B, Section VI).

6.00.00 Thermal Insulation

All necessary Insulation including cladding, lagging, reinforcement, wire mesh, cleats, supports etc. for Engines (if applicable), piping, valves ducting, stacks etc. conforming to the requirements as brought out in the equipment specifications.

If thermal insulation for engine is applicable, it shall be as per engine manufacturer standard practice.

7.00.00 Pipes and fittings

- i. Piping, fittings, plugs, stubs, flanges and other accessories for the piping systems identified above and as per approved schemes.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

- ii. All standard and non-standard matching pieces as needed within piping systems and for connection of piping systems to various equipments/ tanks/ vessels/ valves etc.
- iii. Pipe stubs for mounting thermowells and other instrumentation along with necessary reducers/ matching pieces and instrument tubing.

8.00.00 Paint and primers as required and suitable for the environment/conditions prevailing at site.

9.00.00 Miscellaneous Erection and Cleaning Material

- i. All erection material such as bolts, nuts, washers, gaskets, electrodes, filler materials, welding gas, consumable inserts and backing rings, accessories and miscellaneous specialties required for the proper installation of piping, ducting and all systems.
- ii. All valves, tanks, pumps, chemicals, caps, blanking plates, spool pieces, auxiliary structural steel, flow nozzles & specialties and other accessories as required to complete, chemical cleaning operation and hydro testing of piping systems as per specification and approved schemes.
- iii. Weather hood for pipes crossing ceilings and walls.
- iv. All other materials required for completing the erection, testing & commissioning.

10.00.00 FUEL GAS SYSTEM

10.01.00 RLNG shall be made available by the owner/client within the plant premises. If required, Bidder shall make necessary arrangements for level of gas pressure required for the offered Gas Engine(s). Bidder shall provide common Gas flow meter (common to all Engines) as well as individual gas flow meter for each Gas Engine as per relevant standards. Location of above meters shall be finalized during detailed Engineering.

10.02.00 Fuel Gas System

- i. Emergency Stop Valve (which can be operated remotely from control room) at the inlet to the system to cut-off supply of gas to the power station in case of emergency. Further manual isolating valve shall also be provided at the inlet of Gas terminal point.
- ii. Any other system/equipment required to meet the intent of specification.

11.00.00 WATER SYSTEM

11.01.00 GENERAL INFORMATION

11.01.01 The seawater will be used as source of water for the operation of power plant. The freshwater requirements (i.e. Engine jacket cooling, Lub oil cooling, potable water, Service water, intermittent fire water requirements etc.) for the power plant, is to be met by freshwater generated through desalination of sea water in the envisaged Sea water Reverse Osmosis (SWRO) desalination plant.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

Sea water will be drawn from the sea water Intake system for desalination and the rejects from the desalination plant (brine) and other treated effluents (if any) shall be discharged into the sea complying to SPCB/CPCB norms & at a suitable location specified elsewhere.

11.01.02 Sea water analysis is attached herewith as Annexure-II of Project Information chapter. However, the bidder shall carry out sea water analysis and design the Desalination plant considering the worst parameters.

11.02.00 **SCOPE OF WORK**

The scope of work shall include design, manufacture, engineering, inspection, testing at manufacturer's work(s), packing, supply, forwarding to site, unloading, erection, supervision, pre-commissioning, testing, commissioning and performance testing of the equipment/system and works indicated in this Sub-section of the technical specification.

Any item or works though not specifically mentioned in this specification but needed to complete the equipment & systems to meet the intent of the specification shall also be provided by the bidder.

Scope of supply & services shall include but not be limited to the following-

a) INTAKE WATER SYSTEM

Bidder to design and install sea water intake system of 2X100% capacity intake water pumps based on pumping requirements (Minimum capacity of each pump- 10m³/hr) along with associated required size pipelines (2x100%), hypochlorite/electro-chlorinator dosing system, Piping & fittings, valves, proper piping supports, process instruments etc. from the source/intake system located at sea to the desalination plant location.

b) PRE- TREATMENT SYSTEM

- i) Two (2) Nos Sea water storage tanks each of minimum capacity 25 m³.
- ii) 1x100% capacity pre-treatment plant consisting of Tube settler / Lamella type clarifier along with associated scrapper mechanism reduction gear.
- iii) Two (2) Nos above ground located clarified Sea water storage tanks each of minimum Capacity 25 m³ to store clarified sea water supplied from clarifiers.
- iv) 2x100% capacity of Filter feed pumps.
- v) Two (2) stage filtration system in series comprising of 1st stage Dual media filters (DMF) and 2nd stage Cartridge type filters, each of 2x100% capacity.
- vi) Two (2) Nos feed water storage tanks each of minimum capacity 25 m³.
- vii) One number RCC sludge pit in two (2) sections of minimum capacity of 4 Cum/each section to collect sludge from the clarifiers.
- viii) One (1) number (1x100%) of Sludge thickener, pumps, to treat the sludge from clarifier /tube settler etc.
- ix) 2x100% capacity each of sludge disposal pumps, filter back wash pumps & filter blowers.
- x) 2x100% capacity each of sludge disposal pumps, filter back wash pumps & filter blowers.
- xi) Complete Dosing systems for the Pre-treatment.

c) ULTRA-FILTRATION SYSTEM

- i) 2x100% capacity of UF feed pumps with electric motor and variable frequency drive (VFD).

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- ii) 2x100% common Self-Cleaning strainers at the upstream of all UF train/stream.
- iii) Ultrafiltration (UF) plant with 2x100% capacity of UF skids / train.
- iv) One (1) number of UF permeate water storage tank of minimum capacity of 20 minutes retention.
- v) 2x100% capacity of UF backwash pumps with electric motor and variable frequency drive (VFD).
- vi) 2x100% capacity of UF permeate transfer pumps.
- vii) Complete skid mounted CEB, CIP & online flushing systems for flux restoration and materialization of useful life of UF membrane modules.
- viii) 2x100% capacity of Blowers (If applicable)

d) SWRO (SEA WATER REVERSE OSMOSIS) SYSTEM/ DESALINATION PLANT

- i) 2x100% of capacity Sea water Reverse Osmosis (SWRO) Streams/trains module rack assemblies complete with permeators, sampling facilities and automatically operated brine control valves.
- ii) 2x100% of capacity 1st stage High Pressure (HP) SWRO feed pumps, Energy (ERU) Recovery Units with associated booster pumps (if any).
- iii) Complete suck-back arrangement.
- iv) Two (2) Nos. of 1st Stage RO permeate water storage tanks each of minimum retention time of 20 min. capacity.
- v) 2x100% of capacity Permeate transfer pumps to feed 2nd stage HP Feed Pumps through Cartridge Filters.
- vi) RO Flushing & Cleaning Systems - Complete Chemical cleaning and Flushing system comprising the necessary tanks and pumps for SWRO trains/streams.

e) POST TREATMENT AND TREATED WATER STORAGE SYSTEM

- i) Dosing systems complete for the Post-treatment- Alkali dosing system of treated water, Neutralization system by addition of sodium hypochlorite. Remineralisation system by addition of calcium chloride to balance the hardness of treated water.
- ii) Two (2) number of clarified water storage tank each of minimum capacity 25 m³ to store clarified water with all accessories, for feeding to various clarified water requirement through 2x100% of capacity clarified water pumps for misc. plant use at downstream applications.

f) RO (2ND STAGE) SYSTEM

- i) 2x100% of capacity High Pressure (HP) -RO feed pumps, to feed 2nd stage RO system through 2x100% of capacity Cartridge Filters.
- ii) 2x100% of capacity RO Streams/trains module rack assemblies complete with permeators, sampling facilities and automatically operated brine control valves.
- iii) Two (2) Nos. of 2nd Stage RO permeate water storage tanks each of minimum capacity of 20 cum.
- iv) Complete system for chemical cleaning and Flushing system comprising the necessary tanks and pumps for RO trains/streams.
- v) Complete suck back arrangement along with Permeate booster pumps (If applicable).
- vi) Degasification system, as applicable.

g) REJECT WATER HANDLING SYSTEM –

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- i) Brine water collection and disposal system comprising One (1) number of capacity Filter Backwash water storage tank and Brine water storage/dilution tank of required size, 2x100% of capacity Waste Disposal Pumps.
 - ii) Reject water (brine) from the brine dilution tank shall be pumped using HDPE feeder pipe into a reject Well.
 - iii) Reject water from the reject well shall further be carried to the outfall location by gravity through HDPE pipeline. The entire pipeline shall be laid on the seabed and anchored to anchor blocks. Mechanical items required for anchoring pipeline to anchor blocks are in contractor's scope & shall be of suitable MOC.
 - iv) At the outfall location, the pipeline will rise above seabed at a T-junction into a diffuser block designed to disperse and distribute the reject water (brine). Required riser pipes & check valves diffuser arrangement and of suitable MOC are to be provided by contractor.
 - v) 2x100% of capacity Reject Water Pumps.
- h) CHEMICAL SUPPLY, STORAGE & DOSING SYSTEM (PT, UF & Desalination system)**
- i) 2x100% of capacity of each type of pumps for chemical transfer, preparation and dosing.
 - ii) Two numbers of each type of chemical measuring tanks of required capacity (Minimum 0.30 Cum capacity).
 - iii) Two numbers of each type of Bulk chemical storage tanks of required capacity (Minimum 3 Cum capacity).
 - iv) Supply of all chemicals for complete water treatment facilities for one (1) year of Operation after PG test including first fill for all the systems as per system requirements & as specified.
- i) POTABLE WATER SYSTEM**
- i) Chlorination System- 2x100% capacity Hypochlorite/electrochlorinator dosing system of required capacity for RO permeate water to ensure persistence of a residual chlorine dosage to maintain quality of water suitable for potable purpose. Potable water will be further disinfected with ultra-violet unit to ensure quality and safety prior to the release to the distribution network.
 - ii) Potable water storage tanks (2x100%) of minimum capacity 5 Cum, Potable water pumps (2x100%) all piping/valves/fittings for potable water system.
- j) SERVICE WATER SYSTEM**
- i) One (1) numbers of service water tanks (twin section), each section minimum capacity 20 Cum.
 - ii) Service water pumps (2x100%), Rainwater harvesting pumps (2x100 %), all piping/valves/fittings for Service water system.
 - iii) In addition to cater plant service water requirements, service water pumps & rainwater harvesting pumps shall also be used to fill intermittent tank further used to cater plant fire water requirements.
- k) EFFLUENT TREATMENT PLANT SYSTEM**
- i) Service water effluents from various areas shall be separately collected in respective area pit and the same shall be pumped/routed to wastewater pit of minimum capacity 30 m3 in Effluent treatment area.
 - ii) Oil water separation system (1x100%).

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- iii) From wastewater pit, water shall be pumped up to lamella clarifiers/tube settlers (2x100%) for its treatment.
- iv) Treated water shall be collected in central monitoring basin (CMB) of minimum capacity 20 m³.
- v) The treated effluents conforming to the prescribed standards shall be recirculated and reused within the plant. Treated service water shall be sent back to service water tank for re-use to the extent possible. Further supernatant flow if any, shall be discharged to sea complying to CPCB/SPCB norms specified elsewhere.
- vi) 2x100% of capacity wastewater disposal pumps & all associated piping's, valves etc. up to reject well.

I) GENERAL

- i) All pumps/blowers shall be equipped with electrical drives. All interconnecting piping, valves, fittings, support etc. to complete the system shall be provided.
- ii) In plant process piping & utility piping (Service water for the plant including service water chemical preparation tanks, potable water etc.), fittings, valves, proper piping supports, process instruments etc. to meet service water, potable water and process water requirements shall be provided.
- iii) All the fasteners like Nuts, Bolts etc. shall be of Duplex material.
- iv) Suitable/ as applicable handling arrangements for all equipment of water treatment systems such as intake, PT, UF, Desalination, ETP etc. shall be provided.
- v) Further, all the facilities of water treatment systems shall be located inside structural shed.
- vi) Required numbers of safety shower units and adequate number of Eye fountains to protect against any chemical hazard shall be provided.
- vii) Required platform, ladders etc to facilitate approach to various tanks, manholes/hand-holes, sight-glass, operation & maintenance of valves, instruments etc shall be provided.
- viii) The plant will be made of high-quality materials and all components used will be anticorrosive thus preventing damage due to saline water and saline environment. Contractor shall take full responsibility that all materials and components of valves, pumps, piping/fittings and other equipment and appurtenances shall be compatible with sea water/permeate water and the respective fluids herein.
- ix) The Contractor shall supply all required anchor bolts, foundation plates, sleeves, nuts, inserts etc. Each equipment skids shall be provided with suitable lifting lugs, eyebolts etc. to facilitate erection & maintenance.
- x) Contractor shall take full responsibility for design of intake system, design & sizing of pre-treatment plant, Ultrafiltration plant, desalination plant, effluent treatment plant & other facilities.
- xi) Any additional equipment required to make the system complete and all miscellaneous items that are necessary to ensure safe and reliable operation of the plant during start-up, continuous running, shutdown, and emergency conditions even if these are not explicitly mentioned in this specification.

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11.03.00
11.03.01

EQUIPMENT DESIGN/SIZING CRITERIA

Pre-Treatment System

(i) Tube settler/clarifier: -

The overall area of the unit shall be based on an average flow velocity not more than 3 m³/m²/hr. The unit shall be designed with a minimum retention time of 90 minutes in the settling zone. Larger retention time may be provided to meet the equipment guarantee.

(ii) Thickener:

Capacity of thickener shall be as per design (Considering sludge generation from all clarifiers (PT & ETP) With 5% margin over the above total requirements). The thickener shall be capable of thickening the sludge to 7% solid consistency. Hydraulic circuit shall be such that overflow from thickener shall flow by gravity.

(iii) Dual Media (DMF) Filters

Filtration Capacity of Dual media filters shall be as per system requirement with 5% margin. DMF shall be designed for surface flow rate of not more than 7 m/hr. Only one filter shall be backwashed at a time. Backwashing & air scouring of filters shall be done in not less than 24 hours. Air blower shall be used for air scouring of filter bed. Type of media shall be sand and Anthracite with depth of media min. 1200 mm along with supporting media of Gravel of min. 350mm. Sand shall be of hard and resistant quartz or quartzite and free of clay particles, soft grains and dirt of every description. There should be different size and distribution of Sand and gravels as per standard practice.

(iv) Cartridge Filters

The cartridge filter shall be provided with a differential pressure measurement to monitor the pressure drop across the cartridge filter.

11.03.02

Desalination System

S.NO	PARTICULAR	DESIGN CRITERIA
1	Type of Desalination System	Preferably Skid Mounted
2	Desalination Process	UF + RO + Post-treatment
3	Number of Trains (UF+RO)	2 x100 %
4	Net output from 2nd stage RO Plant of each train at design condition (Minimum Permeate Flow Rate)	4 m ³ /hr
5	Self-Cleaning Strainer	~ 100–150-micron size (at inlet) Designed to clean one section of the strainer media at a time.
6	Cartridge Filter	
(i)	Filtration capacity	Shall not be less than gross capacity of each train meeting the effluent quality
(ii)	Filtering Efficiency	95 % down to 5 micron
(iii)	Filter element	Polypropylene wound filament
7	UF System	

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(i)	UF membrane		Hollow-fiber, pressurized type
(ii)	Fluid Handled		Filtered sea water delivered by Dual Media Filters of PT System
(iii)	Design Capacity of UF		To suit system requirement i.e. UF Permeate Flow (Net) + water required for backwashing of UF membrane + chemical preparation requirements + any other system requirement considered by Bidder
(iv)	Membrane material		Polyvinylidene di fluoride (PVDF) or Polyether sulfone (PES)
(v)	Gross maximum design flux rate		Not be more than 65 l/m ² /h.
(vi)	UF recovery		Not be less than 92%.
(vii)	Pore size of membrane		Not more than 0.04 microns
(viii)	Design permeate water quality		Turbidity < 1.0 NTU, SDI < 3, S&DSI<0.5, Chlorine (ppm) -Nil, pH-6.5-7.0.
8	RO System		
(i)	Gross Capacity of each Train - 1st stage RO plant / 2nd stage RO Plant		Net Output of each Train + internal consumption of RO system + chemical preparation requirements + any other system requirement considered by Bidder
(ii)	Guaranteed Recovery (design)	2nd stage RO	Not less than 75%
		1st stage RO	Not less than 35%
(iii)	Average Flux (design)	2nd stage RO	25 L/M ² h
		1st stage RO	14 L/M ² h
(iv)	Design Inlet Water quality	2nd stage RO	Permeate Water as received from SWRO (1st Stage RO)
		1st stage RO	Filtered sea water from PT Plant
(v)	Design Water Temperature range		25 -32 deg C
(vi)	Membrane type		Polyamide, Spiral wound suitable for Sea water
(vii)	Fouling Allowance for design	2nd stage RO	Minimum 5% per year
		1st stage RO	Minimum 10% per year
(viii)	Salt passage increase	2nd stage RO	Minimum 10% per year
		1st stage RO	Minimum 15% per year

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

(ix)	Design Effluent water quality (Total Dissolved Solids)	< 100 ppm
9	Process water quality	As per requirements of Gas Engine Supplier Note: - Refer Requirements in demonstration parameters

11.03.03 **Pumps:** - All the pumps/Blowers shall be designed with head as per system requirement considering minimum water level +10% margin in frictional head loss.

11.03.04 **Tanks (Other than Chemical tank):** - Min 30-minute retention time of system requirement or as specified in technical specification, which is higher. All tanks shall be equipped with associated accessories like Manhole, Staircase, Platform, Vent, Drain, Overflow Hand railing etc.

11.03.05 Potable water system shall meet the drinking water required for all the plant facilities/ buildings.

12.00.00 PLANT AUXILIARY SYSTEMS

12.01.00 COMPRESSED AIR SYSTEM FOR INSTRUMENT & SERVICE AIR APPLICATION

- a) Two (2) numbers (2x100%) oil free, rotary screw type air cooled air compressors for instrument air and service air applications for complete plant each of adequate capacity & adequate pressure, with their motor drives and other accessories as per equipment sizing criteria mentioned in Volume-IV (Plant Performance & Design Philosophy), Part-A of Technical Specification. However, minimum capacity of each air compressor shall be 5 Nm³/min at discharge pressure of 8.0 Kg/cm² (g).
- b) Two (2) numbers (2x100%) air-cooled Air-Drying Plants (one for each air compressor) of adequate capacity with all interconnecting piping, valves, fittings, etc.
- c) Two (2) numbers of Air Receiver of minimum capacity 2 m³ (one at the discharge of each Air compressor).
- d) Complete instruments, control system with panels as required for compressor
- e) Any additional items required to make the system complete.
- f) For detailed specification of Compressed air system and selection of the required capacity and discharge pressure of Air compressors, please refer Part-B of technical Specification.

12.02.00 FIRE DETECTION AND PROTECTION SYSTEM

The fire detection and protection system shall consist of:

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a) **Fire Water Pumping System**

Complete fire water pumping system consisting of two (2) nos. fire water storage tank, one (1) no. intermediate fire water tank, fire water pumps & drives (common for hydrant system and spray system), fire water transfer pumps & drives, batteries and battery chargers for the diesel engines drives, automatic pressurization system consisting of electric motor driven jockey pumps, required instruments, controls, and panels as per the detailed specifications in Part-B of technical specification.

b) **Hydrant System**

Hydrant system for complete power plant covering main plant building, switchyard-transformer area, all pump houses and various miscellaneous buildings of the plant, etc. as per the detailed specifications in Part-B of technical specification.

c) **HVW Spray System**

Automatic fire detection cum high velocity water spray system for various transformers, lube oil tanks and purification unit, feed pumps of lube oil system, etc.

d) **MVW Spray System**

Automatic fire detection cum medium velocity water spray system for the various cable galleries in main plant and switchyard building, DG set oil tanks, etc. as per the detailed specifications in Part-B of technical specification.

e) **Inert Gas Extinguishing System**

Automatic gaseous fire extinguishing system using inert gas agent as per NFPA-2001 for control room, control equipment rooms and associated C&I rooms like programmer/server rooms, panel room, UPS/Battery charger rooms of main plant building as per the detailed specifications in Part-B of technical specification.

f) **Control System for Fire Detection & Protection**

Fire detection & protection control system shall consist of PLC based control system, analogue addressable fire alarm system consisting of fire alarm panels, repeater panel, various types of fire detectors, control cabling, centralized monitoring station etc.

PLC based control panels

- i) Dual processor PLC based control system with two OWS and one A4 size color Laser printer for fire water pumps and associated systems located in fire water pump house.

Fire Alarm System

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Bidder to provide fire detection system as described below:

- i) Addressable fire alarm panels shall be provided in main control room and shall include but not be limited to the following elements: -

Analog Addressable Fire Detection and Alarm System panels with Master processor module, monitoring modules, supervisory control modules, input/output modules, auxiliary relay modules, network modules and Power supply system (batteries and battery chargers, suitable for providing battery backup of 24 hours (stand by) and 30 minutes (in alarm conditions), etc.

Fire alarm panel shall be interconnected with repeater panel and with PLC panel of fire water pump house such that information related to fire alarm system can be viewed from any panel.

- ii) Centralized PC based monitoring station along with mini-UPS and one A4 size color laser printer shall be provided for main control room. It shall serve the purpose of Central PC Station with facility of monitoring information related to all fire alarm system and of operating drives of fire water pump house.
- iii) One number addressable type repeater annunciation panel in central fire station with power supply system (batteries and battery chargers, suitable for providing battery backup of 24 hours (stand by) and 30 minutes (in alarm conditions), etc.
- iv) Software and hardware as required to provide a complete functioning of the system.
- v) Fire alarm panels shall provide contacts to CCTV, air conditioning system and ventilation system of engine hall for initiating control functions like shutdown of fans/air conditioning equipment, tripping of transformers, etc. Details for the same shall be finalized during detail engineering.
- vi) Fire detection & protection system shall have the provision for future interconnection with Employer's LAN/WAN preferably from a single point.
- vii) Short term fireproof cable shall be used for inert gas protected areas as follows:
- (a.) Detector to detector / isolator/interface unit and detector/ interface/ isolator unit to JB.
- (b.) Detector cables outside the building shall be corrugated steel taped armored laid through cable trays wherever available and for rest of the areas, cable shall be buried at 600 mm depth with sand filling and brick covering at the top.

Detector cable within the building shall be unarmored & laid through GI conduits to prevent damage.

Remote manual operation of the deluge valves shall be possible from the fire alarm control panel through the keyboard operation of PC monitoring station when the system is selected in remote manual mode.

Power Supply System

The DC Power Supply system shall consist of the following system(s):

- i) 24 V DC power supply system for each PLC based control system shall comprise of two sets, each set shall consist of 1x100% microprocessor controlled, intelligent, modular rectifier banks, Controller – one for each rectifier bank, 1x100% Nickel - Cadmium batteries for one (1) hour duty, 1x100% DC distribution board and 1x100% Microprocessor controlled Battery Health Monitoring System (BHMS)–common for both the sets.
- ii) One set of 24 V DC power supply system comprising of 2x100% Chargers and 1x100% batteries for each fire alarm panel and repeater alarm panel with battery backup of 24 hours (standby) and 30 minutes (in alarm conditions).

For detailed specification of power supply system, please refer Part-B of technical Specification.

g) Fire Extinguishers

- i) Fire extinguishers shall be installed in all the buildings within plant boundary as per TAC requirement.
- ii) The Contractor shall supply the following minimum quantities of fire extinguishers and install the same at various locations. However, the actual quantity shall be as per TAC requirement.

1.	Portable type:	
	Pressurized water type (9 lit. cap.) (IS:15683 operated by CO2 cartridge type)	30 Nos.
	Foam type (9 lit. cap. IS: 15683)	15 Nos.
	CO2 type (4.5 kg. Cap. IS: 15683)	30 Nos.
	Dry Chemical powder (6 kg. Cap. IS: 15683)	25 Nos.
2.	Mobile type:	
	Foam type (60 lit. cap. IS: 16018)	1 Nos.
	CO2 type (22.5 kg. Cap. IS: 16018)	5 Nos.
	Dry Chemical powder (50 kg. Cap. IS: 16018)	5 Nos.

h) Fire Tenders and Fire Station Equipment

Fire station building shall be equipped with all the equipment as required for efficient operation of the fire squad. The scope of equipment includes but not limited to the followings:

- i) One number fire water tender, Type-B for fire brigade use as per IS:950 with all accessories listed in IS.
- ii) One no. foam tender with all accessories as per IS: 10460 and its appendices.

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- iii) One no. fire jeep with trailer pumps and with all accessories as per IS: 944 and its appendices.
- iv) Four (04) Nos. of fire suits as per relevant IS code.
- v) Ten (10) Nos. of breathing apparatus as per relevant IS code.
- vi) Two sets of first aid kits as per relevant IS code.
- vii) Two sets of telescopic ladders as per relevant IS code.
- viii) Ten (10) sets of fiber glass blankets as per relevant IS code.
- ix) Four (4) nos. multi-purpose nozzles.
- x) One (1) no. portable thermal imaging camera.

For detailed specification of fire tender and fire station equipment, please refer Annexure-III, Chapter M4, Volume-I, Part B of technical Specification.

- i) One (1) number chain pulley block of minimum two (2) ton capacity along with Monorail and its supports for fire water pump house.
- j) All pylons required for transformers, etc. shall be anchored to soak pit base slab of individual transformer, paved area outside soak pit, etc. using anchor fasteners of adequate capacity. No separate foundation/pedestal for pylons shall be provided by Employer. Subsequent to fixing the pylons, lower part of pylon which would be within filled up gravel portion shall be encased with concrete by Employer for corrosion protection.
- k) Grouting, dressing and final finishing of all foundations of various equipment, etc.
- l) Supply of structural supports for piping in trench (if any) and for above ground piping wherever applicable.
- m) Supply and erection of all bolts, foundation bolts, nuts, gaskets, packing, hangers supports clamps, and all accessories required to complete erection and commissioning shall be in bidder's scope. Inserts/embedment required for all pipes running over-ground on pedestal and in trenches (if any), etc. shall be provided by bidder. All clamps, channels bolts nuts, etc. to support/mount piping with employer's trestle/structure shall be supplied and erected by the contractor. All inserts to be embedded in concrete required for equipment foundation (pump/engine/fuel oil tank, etc.) shall be in bidder's scope.
- n) Acoustic enclosure (if required) for diesel engines of fire water pumps shall also be provided by the Contractor to limit the noise level as specified.

NOTE: Bidder to refer Annexure-II, Chapter M4, Volume-I, Part-B of technical specification for major Technical Data.

13.00.00 AIR CONDITIONING SYSTEM

a) General

Complete Air conditioning system consisting of Packaged air conditioner, Hi-wall split air conditioner /Cassette Air conditioners, air distribution system (ducting, filters, piping, valves, isolation dampers, motorized fire dampers, diffusers, grills, etc.) etc., along with all electrical equipment and instrumentation as required for all the buildings which are in the scope of the bidder, as detailed out in Part-B of technical specification.

b) Air-conditioning system for Main Plant Control room.

Packaged Air conditioners (Ductable type) of suitable capacity with 100 % redundancy shall be provided for main control room building.

c) Cassette and Hi-wall Air-conditioners

For office, meeting/conference rooms, various miscellaneous rooms/areas covered under bidder's scope, etc. which require air conditioning.

d) The capacity (TR) shall be the actual output of the Hi wall /cassette / packaged air conditioners under specified design outdoor and indoor condition. Nominal ratings of Hi wall /cassette / packaged Air conditioners will not be acceptable.

e) Any additional items required to make the air conditioning system complete.

f) For Air conditioning system, the Contractor shall provide all Instrumentation systems, accessories and associated equipment, which are included in Contractor's scope, in a fully operational condition. The Contractor shall also provide all material, equipment and services which may not be specifically stated in the specifications but are required for completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications.

g) Details related to control system of air conditioning system are indicated in Control & Instrumentation, Scope of Supply & Services, Part-A of Technical Specifications.

14.00.00 VENTILATION SYSTEM

a) General

Complete ventilation system consisting of supply air fans, roof extractors, exhaust air fans, louvers, filters, etc., for all the buildings /areas which are in the scope of the bidder, as detailed out in Part-B of technical specification.

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b) **Main Plant building and associated areas**

The main machine hall shall be ventilated by a combination of roof extractor fans and supply air fans fitted with pre filter & fine filter.

c) **Switchgear building in transformer area & LT switchgear room**

Switchgear building in transformer area & LT switchgear room shall be ventilated by a combination of back draft dampers and supply air fans fitted with pre filter & fine filter.

d) **Miscellaneous areas:** All other areas like pump houses, MCC rooms and switchgear rooms, stores, pantry, etc. covered under Bidder's scope shall be ventilated by a combination of supply air fans & roof exhaust fans or supply air fans & exhaust fans or supply air fans & back draft dampers or fresh air in-take louvers & exhaust air fans. For ventilation of battery rooms and oil rooms, flame proof motor shall be used. Further, toilets shall be provided with propeller type exhaust air fans.

e) Any additional items required to make the system complete.

f) For Ventilation system, the Contractor shall provide all Instrumentation systems, accessories and associated equipment, which are included in Contractor's scope, in a fully operational condition. The Contractor shall also provide all material, equipment and services which may not be specifically stated in the specifications but are required for completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications.

15.00.00 ELEVATOR, CRANES AND HOISTS ETC.

15.01.00 **EOT Cranes**

Required numbers of Electric Overhead travelling (EOT) type cranes for various areas/ buildings as specified in other sections of this volume & Part-B, Section-VI of Technical Specification.

15.02.00 **Monorail Hoists**

Required numbers of monorail hoists along with its supports for handling of various equipment of pump houses, various equipment of Desalination plant, various pumps and motors in pump houses, compressed air system etc. as specified in Part-B, Section-VI of Technical Specification.

Requirement of EOT Cranes and Hoists as mentioned above is only indicative and bidder to provide lifting arrangement in all areas as required.

15.03.00 **Passenger Elevators**

The Passenger elevators for Common control room/ Utility building shall be as under.

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- (i) 01 nos. conventional type elevator having capacity of 6 persons (408 kg.)
- (ii) The scope shall include all items / accessories, service along with all electrical equipment etc. required to meet all design, installation, operation, safety, protection and other requirements of IS:14665 (latest edition) (all parts). This scope shall include all items / devices needed to comply with the requirements indicated elsewhere in the specification. The scope shall include but not limited to the following:
 - a) 1 No. fireman's switch for each elevator.
 - b) Machinery supporting Beam.
- (iii) Complete erection, testing and commissioning including all testing and commissioning materials, consumables and other tools and tackles required for erection
- (iv) To obtain necessary local administration permits /approvals and make arrangements for inspection and tests required thereby.

15.04.00 **Hydraulic Crane , Battery Operated trolley & Fork Lift**

Bidder shall supply 1 (one) no. 15 Ton capacity hydraulic crane, 1 (one) no. min. 3 Tons capacity medium size multipurpose battery operated trolley and 1 (one) no. min. 1 Ton capacity Fork lift.

Design of Crane, Trolley & Fork Lift shall be in line with relevant standards and codes, details of which shall be finalized during the detail engineering.

16.00.00 CONTROL AND INSTRUMENTATION SYSTEM

16.01.00 GENERAL

- 16.01.01 a) The Contractor shall be responsible for design, material procurement, fabrication, programming, testing, packing, unloading, storage, shipping, installation & commissioning of a complete PLC based control system for the Gas Engines, Common and electrical systems with all related services in accordance with intent and requirements of the specification.. The Contractor shall provide all systems, equipment, accessories and associated equipment, which are included in Contractor's scope, in a fully operational condition acceptable to the Employer. The Contractor shall provide all material, equipment and services so as to make a totally integrated Instrumentation and Control System together with all accessories, auxiliaries and associated equipments ensuring operability, maintainability and reliability. The work shall be consistent with modern power plant practices and shall be in compliance with all applicable codes, standards, guidelines and safety requirements in force on the date of award of the contract. The requirements of statutory Authorities (e.g. MOEF, Inspector of Factories, IBR, TAC, CPCB/SPCB/CERC etc with regard to various plant areas like main plant, Fuel Gas Plant/System, Chlorinating Plant, Water treatment system, Fire fighting system, Emission measurements etc.) shall be complied even if not actually spelt out.
- b) The Contractor shall provide all material, equipment and services which may not be specifically stated in the specifications but are required for

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completeness of the equipment/systems furnished by the Contractor and for meeting the intent and requirements of these specifications. The work shall be consistent with modern Gas Engine based power plant practices and shall be in compliance with all applicable codes, standards, guidelines and safety requirements in force on the date of award of the contract.

c) The Contractor shall also provide all the instruments along with cables, JB etc. for equipments / drives and services which may not be specifically stated in this specifications but are required for completeness of the Control system shall be furnished by the Contractor and for meeting the intent and requirements of these specifications. All instruments/ equipments etc. shall be suitable for highly corrosive environment prevalent in the coastal area. For coastal areas, all instruments/ equipments shall be provided with durable epoxy/ polyurethane coating for housings and all exposed surfaces of all instruments/ equipments.

d) The Contractor scope shall include design, manufacture, engineering, inspection & testing at supplier's works, packing, forwarding to site, unloading, erection, testing & commissioning. The following clauses describe the brief scope of supplies. It is intended to provide the brief scope only, any other equipment/system required for ensuring the safe, reliable and trouble free operation of the plant under the present scope of the work shall be provided within the lump sum quoted price of the contract. The detailed technical specifications are stipulated under Part - B, of the specification including all annexure, appendixes etc. However, Contractor to ensure the functionality & operability of the complete system in all regimes of operation.

e) All other special instruments/ equipments for which specifications are not provided in Part-B, of technical specifications shall be provided as on required basis as per OEM Standard & Proven practice. Contractor's offering as per his "standard and proven practice" shall be accepted based on the documentary evidence.

The detailed technical specifications are stipulated under Part - B, Section-VI of the specification as well as in various other Parts of the Technical Specifications.

16.02.00 MEASURING INSTRUMENTS

16.02.01 Primary instruments like Microprocessor based transmitters employing HART protocol, thermocouples & RTDs along with temperature transmitters, pressure/diff. pressure/temperature/flow transmitter & gauges, flow sensing elements (orifice plates, flow nozzles etc.), Radar type level transmitters, Gas leak detectors, Fuel Gas flowmeter etc. to be provided on as required basis complying the specification requirement specified in Part B. All the instruments shall be provided to meet the actual system requirements and meeting redundancy and other requirements specified under technical specifications, as per OEM practice, subject to Employer's approval.

16.03.00 CONTROL SYSTEM

The Contractor shall provide PROGRAMMABLE LOGIC CONTROLLER (PLC) based control system for Gas Engines as well as for Common and Electrical

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System Controls. The Control System shall be able to perform automatic sequential start up, run-up, synchronization, loading, unloading and shutdown operation of Gas Engines in safe and efficient manner under all regimes of operation. This shall include auto operation of various auxiliaries/ sub systems like lube oil system, cooling water system, etc. In case Contractor offers DDCMIS in place of PLC based Control system, the same shall be acceptable.

Gas Engine shall be provided with a governing system including speed and load controllers with frequency-droop correction for regulating the fuel flow into the engine. The control system shall be designed for operation as detailed under this technical specification. Other controls which are necessary, and as per the Gas Engine supplier's recommendations are also envisaged.

Automatic Startup and Shutdown Sequencing System shall be provided including all required interlocks, sequence logic and modulating control loops for safe and efficient startup/ shutdown of the Gas Engine.

Three number of Operator Workstation (OWS) and A4 size color Laser printer for controlling and monitoring of the Gas Engines and associated system shall be provided and the same shall be located in Central Control Room. Instrumentation and Control System with interlocks, protection and annunciation for the complete system being provided under the contract shall be provided with all required software and hardware to make the system complete and functional. Additionally, two workstations shall also be provided with capabilities of programming station and historian capability to store at least 2 year of historical data of PLC system (EWS cum OWS). Essential cyber security provisions shall also be provided as per the contractor's standard and proven practice for ensuring secure and reliable operation of the complete system in compliance to latest cyber security guidelines/regulation.

Depending on the cable distance between Central control room and other sub systems, requirement of Remote Input Output (RIO) shall be finalized during detail engineering, in such cases, contractor to provide RIO on as required basis. Contractor shall place RIO cabinets inside RIO rooms with air conditioning environment or else RIO panels shall be provided with panel mounted ACs. RIO rooms, Air conditioning, power supply for RIO cabinets shall be in contractor's scope.

16.04.00 Other Systems

Other Systems like CEMS, AAQMS, UPS power supply, PCP, Instrumentation cables, power & control cables, Optical fiber cables, Junction boxes, Conduits, Cable sub trays, Control valves, Electric Actuators, Master & Slave clock system, CCTV, PA system, Walkie Talkie and C&I lab shall be provided on as required basis/ minimum quantity as specified in Part B for complete plant, meeting requirements specified in Part B Chapter III C of specifications.

16.05.00 Central Control Room

The PLC based control system panels, Control desk, OWS, UPS etc. shall be housed in an air-conditioned Central control room of the Employer. Battery shall be located in an air ventilated area inside the Control Room. The contractor

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shall design the complete system considering the space availability in the Central control room/ Battery room of the Employer and the same shall be finalized during detailed engineering. The contractor shall provide continuous monitoring of temperature & humidity of Control room/ RIO rooms(if any).

17.00.00 ELECTRICAL SYSTEMS

The Bidder scope shall include design, engineering, manufacture, type testing, inspection & shop testing at supplier's works, packing, forwarding to site including customs clearance/ port clearance (if required), receipt and unloading, inplant transportation, handling and storage (preservation & conservation of equipment) at site, erection, testing and commissioning of the Electrical equipment/ system and works as indicated in this chapter. The Electrical scope shall be as described briefly in the following clauses but not limited to it

17.01.00 Generator and Auxiliary System

17.01.01 Generator complete in all respects including stator, rotor, bearings, couplings, terminal pads with palms and all its associated supervisory and instrumentation system.

17.01.02 Complete cooling system as applicable including the necessary piping and pipe supports, valves, measuring system along with the control panel.

17.01.03 Complete excitation system (brushless or static type) with exciter, excitation transformer, thyristors, rectifiers and filters, field flashing and field forcing equipment, rotating diodes etc. as applicable along with the DAVR, de-excitation equipment, cables/bus duct and all necessary control, annunciation and monitoring equipment mounted on suitable panels.

17.02.00 MV Busduct

a) Medium Voltage Busduct and Auxiliary equipment

The standard equipment ratings have been specified in the relevant chapters.

17.03.00 Transformers

S.No	Equipment Name	Rating/Parameters	Quantity
1.	POWER TRANSFORMERS / REACTORS / AUXILIARY OIL FILLED TRANSFORMERS		
i)	Generator Transformer	as per SLD & System Requirement	
ii)	Auxiliary Transformers (including LT Outdoor)	as per SLD & System Requirement	

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S.No	Equipment Name	Rating/Parameters	Quantity
iii)	INDOOR Transformers (Epoxy cast resin/ resin encapsulated)	as per SLD & System Requirement	
2.	TRANSFORMER MAINTENANCE TESTING & MONITORING EQUIPMENTS	Refer Transformer Sub-Section, Part-B of Technical Specifications	
3.	SPARE OIL	Refer Transformer Sub-Section, Part-B of Technical Specifications	5% of total Volume for all Transformers & Reactor

The preferred standard Transformers ratings shall be as indicated in a typical key single line diagrams Drg. No. 6400-999-POE-J-001 enclosed in Tender drawings.

17.04.00 SWITCHGEAR

17.04.01 MV SWITCHGEARS [if applicable for auxiliary power supply network]

Switchgear boards as required along with suitable Busduct / Cable (as applicable), (a typical key single line diagrams for Aux Power Supply (6400-999-POE-J-001 Rev-A) is enclosed). The design and sizing criteria of the Switchboards shall be as detailed at chapter E-9.

All the Switchboards (each section) shall have two (2) no of Modules as spares (whether Outgoing and/or Transformer type shall be decided during detail engineering).

Contractor's scope also includes the Insulating mat for laying in front of MV Switchgears in switchgear rooms.

17.04.02 LV SWITCHGEARS AND LV BUSDUCTS

The scope of work includes the following for feeding all the LV Loads of the power plant as required (a typical key single line diagram for Aux Power Supply Drawing No. 6400-999-POE-J-001 enclosed). The design and sizing criteria of the Switchboards shall be as detailed at Chapter E-10. The major LT Switchgear shall include the following:

- 415 Volt Switchgears
- 415 Volt Motor Control Centers
- 415 Volt AC Distribution Boards

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220 V DC Distribution Boards

415 Volt AC Fuse Boards

220 Volt DC Fuse Boards

Local Motor Starters for Ventillation fans, Local Push Button Stations for all motors except for ventilation fans, Telescopic Trolley for Breaker Handling, Welding / Lighting Transformers

LV Bus ducts

All switchgear, Motor Control Centers (MCCs) & AC/DC distribution boards, etc. shall have at least 20% or minimum two (whichever is higher) fully equipped switch-fuse modules of each rating as spares, uniformly distributed over different vertical sections. In addition, all switchgears, MCCs, AC/DC boards, etc., shall have as spares at least twenty (20%) per cent of starter modules/MCCB module or at least one module (whichever is higher) of each of each rating

Contractor's scope also includes the Insulating mat for laying in front of LT Switchgears in switchgear rooms.

17.05.00 DC System

Battery and Battery Charger

Lead acid plante type/ Nickel Cadmium batteries and Float cum boost chargers for plant ard and all other areas in the scope of the contractor, as per system requirement.

The DC systems (Battery and Charger) shall be supplied to cater to various DC loads in the plant. The design and sizing criteria shall be as detailed out in the chapter E-1, Part-B of Technical specifications.

One set of variable metallic resistor and shunt for each battery rating & location suitable for carrying out the discharge test on the batteries under Contractor's scope shall also be supplied

17.06.00 MOTORS

Motors along with couplings and coupling guards for all rotating auxiliaries covered under this package.

17.07.00 Cabling

Following shall be in the scope of the contractor for the complete plant, building, equipment and switchyard system etc. including interplant areas.

Laying of HT power, LT power and control cables.

Cable trays, fittings and their accessories, along with support system.

Cable glands and lugs.

Straight-through jointing kits for HT XLPE power cable, LT power and control cables.

Cable termination kits for HT XLPE power cables.

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Welding receptacles.

Trefoil cable clamps.

Junction boxes.

Galvanised steel pipes/ HDPE/ Hume pipes/ PVC pipes

Miscellaneous items like M.S. sections etc. as required

Fire proof cable penetration sealing system of Type-A and Type-B for cable galleries, cable exits etc.

(l.) In addition to other drawings, Contractor shall also prepare complete equipment layout drawings, lighting layout drawings including cable tray layout, routing, Power and control cable schedules etc.

(m.) Control interconnection charts shall also be prepared by bidder.

17.08.00 CABLES

17.08.01 HT Power Cables

HT power cables as indicated in typical key single line diagrams for Aux Power Supply (Drg. No 6400-999-POE-J-001) and evacuation system along with necessary termination, lugs and glands as required for the complete plant.

HT cables from 33kV GIS to plant boundary for interconnection to transmission network/Lines are also in bidders scope. Each O/G feeder and associated cable shall be sized for continuous current carrying capacity of 25MVA/440 Ampere (minimum.)

17.08.02 LT Power and Control Cables

LT Power and Control cables as required for the complete plant, building, equipment etc.

17.09.00 Earthing and Lightning Protection

Below ground and above ground earthing mat / Grounding and lightning protection for the complete plant is in the bidder's scope.

17.10.00 Station Lighting

Station lighting system for the plant, buildings and equipment in the bidder's scope. Lighting fixtures complete with lamps & accessories, LED lighting fixture complete with driver circuit & accessories Lighting Panels, Receptacles, Switch boxes. Conduits. Lighting Wires, Ceiling fans with regulators, lighting poles. Lighting masts, Earth wires and rods, Junction boxes, Battery operated automatic self-contained lighting fixture, Maintenance ladders as required are included in the bidder's scope.

Mandatory spare parts and maintenance equipment as required.

LED type lighting fixtures shall be provided for Lighting Mast.

17.11.00 DG SET

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Minimum One Nos. for Diesel Generator sets along with acoustic enclosure of stationary type suitable for outdoor installation to be provided. Mandatory spare parts and maintenance equipment as required.

17.12.00 Electrical Actuators

Electric actuators with integral starters along with associated accessories etc shall be supplied on as required basis for Valves / Dampers to meet the functional and the other specification requirements. Actuators used for control functions shall be continuous modulation type.

17.13.00 Control Philosophy for plant Electrical System

Control of Electrical System shall be provided from DCS/PLC with suitable ECD (Electrical Control Desk) and/or Soft HMI. The details of the same are specified in relevant sections of Control and Instrumentation.

17.14.00 Protection and Metering

Necessary Protection and metering system as detailed in relevant portion of technical specification shall be provided.

17.15.00 CONSTRUCTION POWER

To meet the construction power requirement of the project, DG sets shall be employed by the contractor. The Bidder shall extend supply from these to meet the construction power requirements at the various locations through suitably rated isolation transformers along with LT distribution boards as per requirement. LT packaged substation along with isolation transformers may also be used for the purpose.

Supply, erection, testing and commissioning of overhead lines ring mains, single pole /double pole/ four pole structures with switches, fuse, lightning arrestors, LT transformers, 415V switchboards, power and control cables, DC Systems etc. as required for meeting the construction power requirements, shall be in the bidder's scope. All necessary statutory requirements for charging bidder's construction power network shall be in the bidder's scope. The bidder shall also provide power for meeting the Employer's office/miscellaneous power requirements[100KVA]. Construction power supply network, within the plant, is a temporary arrangement which shall be used during the project construction phase. To meet this requirement, the equipment may be arranged by Bidder either by shifting their existing equipment at other installation or by fresh procurement, which may be taken back after commissioning of the project.

All temporary wiring must comply with local regulations and will be subject to Employer's inspection and approval before connection to supply.

17.16.00 GAS INSULATED SWITCHGEAR

The scope of work is for the Design, supply, erection, testing and commissioning of 33 KV SF6 Gas Insulated Switchgear (GIS) as shown in the Single line diagram with GIS building. The 33 KV switchgear shall employ Double Busbar scheme. The scope of work shall comprise, but not limited to

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the design, engineering, manufacture, testing and inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage and equipment erection. Further the scope shall also include the cabling, lighting, lightning protection, earthing, air conditioning & ventilation, association of sub vendors in the erection, supervision, site testing, inspection and commissioning.

The above scope of work shall also include overall project management, co-ordination, design, engineering, supply, erection, testing and commissioning including AIS portion in Switchyard and take off Gantry at both (Switchyard & plant) end.

17.16.01 Feeder details: Bay details are as shown in the Single Line diagram Drg. No 6400-999-POE-J-001.

17.16.02 Equipment and materials:

I. 33 KV Gas Insulated Switchgear Equipments

- SF6 gas insulated metal enclosed bus bars, Circuit Breakers, Isolators, safety ground switches, High speed fault making ground switches, Current transformers, Surge arresters, GIS ducts, Local bay cabinets, SF6 gas monitoring equipments, Bus VTs, etc,

- Complete earthing grid (inclusive of supply of 40 mm dia MS rod and GI flat) earthing of all GIS equipment.

- Contractor shall make earth resistivity measurements at site (based on four electrode method) and design the earthing grid as per IEEE: 80 (Latest edition) and connect the earthing grid with power plant earthing grid.

- Complete Direct Stroke Lightning Protection using Lightning Mast and/or shield wire and its connection to earth mat.

- Armored Power and control cables, cabling (including interpole and interpanel), cable support angles, cable trays and accessories as necessary for cable erection such as glands, lugs, clamps for cables, ferrules, cable ties, hume pipe etc. cable route markers for buried cable trench are also included in the scope.

- GIS Building
- EOT Crane in GIS Building
- Lighting and Accessories
- AC/Ventilation for GIS building

II. 33 KV Outdoor AIS Isolators as shown in SLD.

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- 17.16.03 The equipment and materials to be supplied by the Contractor shall form a complete 33 KV switching Station. The equipment and services as detailed in all sections of the bidding documents and as shown on the Single Line diagram shall be within the scope of supply of the Contractor. It is in the interest of the contractor to acquaint himself with the site conditions and scope before submission of offer.
- 17.16.04 The list of items covered under the scope of supplies is as mentioned above. Any items though not specifically mentioned but which are required to make the switchyard complete in all respects for its safe, efficient, reliable and trouble-free operation shall also be deemed to be included and the same shall be supplied and erected by the Contractor, unless they are specifically excluded in the text of exclusions given in relevant section.
- 17.16.05 **Following shall be provided for Control & Protection of 33 KV system and Generator Relay Panels.**
- a) Protection system shall be provided with Numerical relays.
 - b) Complete protection system and Substation Automation System (SAS) based on IEC 61850 protocol in all respect including auxiliary systems. The SAS shall comply to the cybersecurity guidelines issued by CEA.
 - c) AC & DC power supply system for entire 33KV system Bay equipment.
 - d) Panel mounted Bay Protection Units (BPU) and Bay Control Units (BCU) for 33 KV bays.
 - e) All protections of 33 KV systems including 33kV Busbar protection as per relevant tender SLDs.
 - f) ABT based energy metering system as indicated in protection SLDs and dummy panels for mounting owner supplied meters.
 - g) Time synchronization equipment (TSE) for switchyard and GRP.
 - h) One dynamic relay test kit.
 - i) PMU, TSE and routers for 33 KV line bays.
 - j) Protection panels for Gen, GT (GRP) to be located in corresponding CER and to be networked as per the Network Architecture Drawing. One number generator DR with both slow and fast scan feature to located in each GRP.
 - k) All networking accessories and workstations
- In addition to the above, the following shall also be provided:-
- 1. All control cables within switchyard, main plant and also for interface between main plant, various transformers and switchyard for the realization of control and protection scheme.
 - 2. Interface between Protection Panels and owner supplied communication system for 33 KV lines.
 - 3. Recommended relay setting files for owners review and approval.
 - 4. Suitable space provisions for installation of Owner's communication panels and Equipments.

17.17.00 PAINTING FOR ELECTRICAL EQUIPMENT

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Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

17.18.00 TYPE TEST

Contractor shall meet the requirements of type tests on electrical equipments as stipulated in relevant chapters of technical specifications.

18.00.00 SUPPLIES FOR PLANT SERVICES

18.01.00 Bidder's Scope of Supply includes Supply of necessary material for the Plant services and Accessories of various equipment and systems as follows.

18.02.00 Complete plant drain system together with all necessary piping, valves, fittings, supports, pumps and drives etc., so as to render the system complete.

18.03.00 All the first fills of consumables such as greases, oil, lubricants, servo fluids / control fluids, chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

19.00.00 ROOFTOP SOLAR

20.01.00 The Solar Photo Voltaic (PV) installation on Rooftop of various available buildings of the Power Plant shall be carried out preferably on shadow free area in such a way that the generation is maximized on each building suitable for installation of Solar PV power plants.

The bidder has to install the solar PV rooftop system on the available buildings identified in this package on the basis of 15 square metre area(shadow free) per kwp and the bidder shall also consider utilizing all the available rooftops(Buildings) for installing solar PV project.

20.02.00 Determination of optimal grid connected roof-top Solar PV power plants capacity on the buildings of the power plant depending on available shadow free area.

20.03.00 Complete design, engineering, manufacture, inspection, supply, transportation, storage, insurance, erection, testing, and commissioning of the grid connected rooftop Solar PV plants including all auxiliaries.

21.00.00 SCOPE OF SERVICES

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- 21.01.00 Bidder's Scope of Services in respect of the equipment/ systems specified shall include all services required for Planning, Design, Engineering, Manufacture / Fabrication, Assembly, Pre-shipment Testing at manufacturer's works, Packing for Transportation, Transportation, Handling, Delivery at Plant Site, Storage, Installation, Interconnection with related plant and equipment, Commissioning, Initial Operation, and Conductance of Acceptance Tests.
- 21.02.00 In addition to above, the Scope includes all other services necessary for meeting the intent and requirements of the specification within his quoted price. These shall include but shall not be limited to the following services for all equipment / systems as per the specification.
- 21.03.00 Engineering Services and Engineering Documentation**
- 21.03.01 Scope includes System Design/ Engineering for all equipment and systems to ensure that the intent and requirements of the specification are fully met. The plant shall be engineered and designed strictly in accordance with the specification requirement.
- 21.03.02 Scope includes preparation, submission and obtaining Employer's approval for all Engineering Drawings/ Documents as detailed in 'General Technical Requirements' (Volume VI, Part A) and tentative Master List of drawings, other sections/ subsections of Part B of Technical Specification. Drawings / documents mentioned above shall be prepared by the Contractor and submitted to the Employer as per schedule to be finalized before the award of this contract. Further, all drawings and documents pertaining to Gas engines and their associated auxiliaries shall be vetted by the qualified Gas engine manufacturer for this project before submitting to the Employer for review and approval.
- 21.03.03 Engineering work shall be performed based on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environment. Employer shall have the right to review and approve the engineering work by himself or herself and/ or through consultant and ask for any clarifications and changes/ modifications to the work performed by the Contractor.
- 21.03.04 In course of review of Design Memorandums and Detailed Engineering, it may be essential in the opinion of Employer to obtain certain classified data for review purposes only. The Contractor shall furnish such data to Employer, if required.
- 21.03.05 **Technical Co-Ordination Meetings**
Scope includes Participation of Contractor's senior personnel and experts as well as major sub-vendors for this package in Technical Coordination Meetings (to be held at EOC NOIDA, Vendor works, Plant site or mutually agreed venue) and other Meetings for discussions on technical issues as required by the Employer.
- 21.04.00 **Type Test Requirements**

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Bidder's Scope includes conductance of Type Tests for Mechanical, Electrical and C&I Equipment as detailed in respective Volumes of Part B, Section VI.

21.05.00 **Packaging, Transportation and Insurance (Ocean & Inland), Dock Clearance**

Scope includes receiving of material/ equipment at site, unloading and proper storage. Proper storage of all mandatory spares and other equipment till handing over to the Employer shall also be under the scope of the Bidder.

21.06.00 **Training of Employer's Personnel**

Scope of training shall include training of Employer's personnel covering entire scope for the package. This shall cover all disciplines viz. Mechanical, Electrical, C&I, QA etc.

Training shall include all the areas related to plant like Design familiarization and training on product design features of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, equipment maintenance, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing erection, welding etc.

Total duration of the training shall be of 5 (five) man months. The break-up of the training period shall be as following-

- i. 1 (One) Man month – At Engine manufacturers works/factory
- ii. 4 (four) Man months - Comprehensive training program consisting of classroom and plant visit of similar running plant for Employer's personnel for safe and efficient operation of the plant addressing the erection, commissioning, operation and maintenance aspects of the plant.

Accommodation with lodging and boarding and local conveyance at the place of training shall be provided to the Employer's personnel free of cost. Cost of journey to and from the place of training shall be borne by the Employer.

Details of the training shall be finalized during detail engineering of the project.

Note: For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person

21.07.00 **Erection, Pre-commissioning, Commissioning, and Initial Operation**

21.07.01 Scope includes complete services for construction, erection, pre-commissioning and commissioning for all specified equipment/ systems. Manpower, equipment, material, consumables, chemicals, instruments and information for above shall be provided by the Contractor.

21.07.02 Pre-commissioning, Commissioning, and Initial Operation shall be in accordance with the specification requirements indicated in 'General Technical

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Requirements' (Volume – VI of Part A) and Part B of Technical Specifications. Materials and services required for Pre-commissioning, Commissioning, and Initial Operation shall be in the Contractor's Scope.

21.08.00 **Start-up of Power Plant**

- (i) Bidder's scope in respect of each Genset Module includes startup following completion of pre-commissioning and commissioning activities. The start-up shall include synchronization and up to base load operation of Genset units. Start-up activity shall also include proving/ establishing all the systems/ automatic controls and protections of the complete Genset modules and associated support systems.
- (ii) Separate start-up reports for all equipment shall be completed before the start of the respective "Initial Operation" of the Genset modules.
- (iii) The time between first start-up and start of 'Initial Operation' shall be considered as a part of the erection and installation period. Bidder's scope includes all commissioning/ operation manpower requirement during the intervening period of Start-up and Initial Operation.

21.09.00 **Acceptance Tests**

21.09.01 The Scope includes carrying out Acceptance Tests at Site for establishing the specified Performance and Functional Guarantees for acceptance by the Employer. Acceptance tests shall be carried out in accordance with the specification provisions of 'Guarantees and Performance Testing' (Volume V, Part A), 'General Technical Requirements' (Volume – VI of Part A) and requirements specified in Part B.

21.09.02 The Contractor shall be responsible for making all necessary arrangements required for conductance of specified tests and accordingly the cost associated with the specified tests shall be included in the bid price. Contractor shall provide permanent arrangements in various equipment/systems for conductance of Performance and Guarantee tests by the Owner periodically. Employer's/Client's responsibility shall be limited to ensure power evacuation and arranging fuel.

22.00.00 **CONSTRUCTION FACILITIES**

22.01.00 Bidder's Scope of Work of for the construction facilities of the project is as follows:

- (i) **Drinking Water** -. Bidder shall arrange and make own arrangements for drinking water.
- (ii) **Construction water** - Water for construction purposes shall be arranged by the bidder. He shall make his own arrangement for drawl, pumping, storage and distribution etc. The drawal scheme, arrangement shall be subject to approval of NVVN. Bidder may discuss his drawl scheme / arrangement during his site visit before submitting his bid. Bidder shall exercise full restraint that the water drawn is minimum and not wasted.

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Quality of construction water should be such that it shall meet the requirement for construction purposes.

No water shall be made available by NVVN for water supply to bidder's staff colony / labour camps. Bidder/Contractor shall arrange necessary accommodation bidder's staff & labour.

(iii) Construction office and other facilities – The Contractor shall make his own construction office, construction store (open/ covered), fencing and construction workshop and material/ field testing laboratory etc. as required.

(iv) All necessary fire fighting devices, equipment, fire tenders and extinguishers etc. required during the project execution stage shall be arranged by the Bidder.

22.02.00 Bidder's Scope includes lifting devices for handling, erection and maintenance of all the equipment and systems during construction stage.

22.03.00 All equipment foundation loading data, all facilities layout and any other additional input as required during construction phase has to be supplied by Bidder.

22.03.00 **SCOPE OF CIVIL WORK**

1. Supply of all inserts including foundation bolts required for fixing and supporting all equipment, skid, vessels, tanks, chimney, electrical panels, C&I panels. Templates required for fixing/installation of foundation bolt shall also be supplied by bidder.
2. Platforms and ladders for approach to platforms.
3. Grout & grouting of all Equipment foundations.
4. Supply and erection of Supporting structure for ducts namely flue gas ducts and bus duct including foundation bolt & grouting below the base plate.
5. Checking of alignments & location of inserts, anchor bolts & pocket in all equipment foundations. Joint protocol to be made and signed by the bidder

22.03.01 **SCOPE OF CIVIL, STRUCTURAL & ARCHITECTURAL WORKS OF WATER INTAKE SYSTEM & BRINE DISPOSAL SYSTEM**

The scope of work covers design, supply & construction of sea water drawl system and Brine disposal into sea based on study carried out from reputed institute including all associated facilities etc. complete as per system requirements. This mainly includes:

- (i) Pump house as per study/requirement and Approach jetty/platform
- (ii) Brine disposal system as per study/requirement including laying of pipelines and outfall arrangement

22.03.02 **CONSTRUCTION FACILITIES**

The following are in the Bidder's scope of work pertaining to construction facilities:

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1. Construction water shall be the responsibility of Bidder during all stages of construction.
2. Construction of temporary facilities like Construction office, Construction stores, Workshops for maintenance, Material/field testing laboratory etc. as per requirement.
3. All necessary fire-fighting devices/equipment/fire tender etc. required during the project execution stage.
4. Area lighting at the construction / erection site, fabrication, pre-assembly and storage yard, office areas, labour and staff colony etc.
5. Providing first aid facilities at the construction / erection sites, workshops, laboratories, fabrication, pre-assembly & storage yard, Offices and other places of work as per the requirement.
6. Housekeeping of all construction area and disposal of construction/demolition waste.
7. The Bidder shall arrange skilled/semiskilled/unskilled labour (from local source(s) as far as available) and supervisory staff for quality execution of all civil, structural and architectural works.
8. Use of ash and ash based products.

In line with Gazette Notification on Ash Utilization issued by Ministry of Environment & Forest and its amendments, Bidder shall use ash and ash based products in all construction.

22.03.03 Corrosive Protection measures shall be provided for the corrosivity category C5 as per ISO 12944-2 with very high durability as specified in Part-B (Civil) of Technical Specifications

23.00.00 SPARES

23.01.00 Following Spares are included in the scope of supply as per the applicable provisions:

- (i) Mandatory Spares
- (ii) Recommended Spares
- (iii) Start-up Spares / Commissioning Spares

23.02.00 Mandatory Spares

- (a) The list of mandatory spares considered essential by the Employer is indicated in this chapter/volume at Annexures – IA, IB, IC & ID. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of mandatory Spares whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to

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quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in the Bid Forms and Price Schedules. Whenever the quantity is mentioned in "sets" it pertains to the requirement for one no. of Engine/Equipment wherever the same has not been detailed in the specification. The bidder has to give the item details and prices of each item

- (b) The Employer reserves the right to buy any or all the mandatory spares parts.
- (c) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.
- (d) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- (e) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- (f) Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case the quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.
- (g) Unless stated otherwise a 'set' means items or subitems required for each type/size range of the assembly/ sub-assembly, required for replacement in one main equipment. It is further intended that the assembly/ sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/ sub-assembly, these shall be considered as different types of assembly/ sub-assembly.
- (h) Whenever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all the items supplied and installed and the breakup for these shall be furnished in the bid.
- (j) Bidder shall not indicate "Not Applicable" against any of the spare (except for those items for which "if applicable" is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules.
- (k) Contractor to provide detail break-up of price for each item/head identified in mandatory spares before NOA. During detail Engineering, if it found that one head has several sub-items//heads, then the price allocated to main head shall be divided by the contractor for each sub-item/head in BBU of Mandatory spares.

23.03.00 **Recommended Spares**

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- (a) In addition to the spare parts mentioned above, the contractor shall also provide a list of recommended spares for 03 years of normal operation of the plant and indicate the list and total prices in relevant schedule of the Bid Form and Price Schedules. This list shall take into consideration the mandatory spares specified in this Part-A and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares.
- (b) Price of recommended spares will not be used for evaluation of the bids. The price of these spars will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Contractor shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

23.04.00 **Start-up & Commissioning Spares**

Start-up and commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the employer shall come under this category. The Contractor shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Contractor.

Bidder shall include in its scope of supply all the necessary Start up & Commissioning spares and indicate these in the relevant schedules of the bid form.

- 23.05.00 The Contractor shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
- 23.06.00 All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
- 23.07.00 All the spares (both recommended and mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
- 23.08.00 The contractor will provide Employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the Employer to identify and finalise order for recommended spares.
- 23.09.00 Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a

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single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

23.10.00 All cases, containers or other packages are to be opened for such examination as may be considered necessary by the Employer.

23.11.00 The contractor will provide the Employer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipment covered under the contract and will further ensure with his vendors that the Employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

23.12.00 The Contractor shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.

23.13.00 In addition to the recommended spares listed by the contractor, if the employer further identifies certain particular items of spares, the contractor shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the Employer and placement of order for additional spares if the Employer so desires.

23.14.00 The Contractor shall guarantee the long term availability of spares to the Employer for the full life of the equipment covered under the contract. The Contractor shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, he shall give the Employer atleast 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-contractors. Further, in case of

discontinuance of manufacture of any spares by the Contractor and/or his sub contractors, Contractor will provide the Employers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the Employer for the purpose of manufacture/procurement of such items.

23.15.00 Material Codification

The bidder to provide datasheets/ assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which mandatory spares to be supplied can be uniquely identified. This would facilitate the Employer to assign a unique code to each of the mandatory spare as brought out in GCC. The bidder shall extend all

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necessary assistance in this regard.

23.16.00 In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the lists of mandatory spares.

23.17.00 Interchangeability and Packings:

All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be preset and/or preprogrammed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre setting/pre programming before putting

them in to service. The spare shall be treated and properly packed for long term storage.

23.18.00 Identification:

Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

23.19.00 Wherever the quantity is given only in percentage, the spare quantity shall be distributed into various ranges/size/rating/type (as the case may be) in the same proportion of the main population. The percentage shall be taken for the full population of the plant, unless otherwise mentioned. For the quantities coming less than 1, shall be treated as 1 only.

24.00.00 TOOLS & TACKLES

The Contractor shall supply within this Contract all necessary maintenance and inspection tools including special tools & tackles required for the disassembly, assembly, maintenance inclusive but not limited to, alignment tools for all rotating equipment, rotor removal equipment, torque wrenches capable of meeting all torque tightening requirements.

Supply of all necessary tools, tackles, and commissioning spares, including all types of electronic modules, power supply units, consumables like printer

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paper, printer cartridge / toner, etc. required for commissioning, initial operation till the completion of facilities, test instruments and deputing of experienced personnel for completion of the above erection, testing and commissioning work. A comprehensive list of all such items envisaged shall be submitted for Employer's review prior to commencement of erection/commissioning activities.

Tools shall be of a suitable brand, new and unused and shall be stored in the correct manner and at appropriate locations.

All Precision and Special Tools shall be required to be accompanied with a Certified Calibration document for twelve months.

A list of tools to be supplied has been included in Annexure-II of this volume. Further, the bidder shall furnish a list of tools & MC equipment with the Bid documents to the Employer, which shall be discussed and finalized during post bid discussions. All tools not listed in the inventory list and found to be necessary for maintenance of the works shall be deemed to be included in the Contract price.

25.00.00 SUPERVISION OF OPERAION & MAINTENANCE/INSPECTION OF PLANT

Scope includes one year supervision during operation and maintenance with deputation of 1 operation and 1 maintenance expert post successful completion of initial/trial operations & Performance guarantee tests including Demonstration tests.

Operation & Maintenance upto start of supervision of O&M shall be in bidder scope.

26.00.00 TERMINAL POINTS

(i)	Fuel	:	Tap-off from gas supplier within plant premises. Exact location of tap-off point shall be informed during detailed Engineering. Bidder to connect gas supply line with incoming gas lines inside the plant boundary at terminal point of gas.
(ii)	Plant Effluent	:	Effluents discharge from disposal pumps to the Sea. RO Reject discharge to sea
(iii)	Electrical	:	(a) Bidder scope is limited upto evacuation switchyard located at power station. Four (4) nos of 33 kV outgoing cable feeders with appropriate metering are envisaged for the same, as indicated in SLD.

27.00.00 EXCLUSIONS

- (i) Power Evacuation system beyond Terminal point as indicated in SLD.
- (ii) RLNG supply.
- (iii) All civil works other than grouting of the equipment and fixing supports in walls, floors and trenches etc. Civil works shall be executed by employer based on detailed dimensional drawings and loading data furnished by the equipment supplier. However, erection including grouting & embedment of equipment, fixing supports in walls, floors & trenches etc. as required is in the scope of bidder and the Contractor shall supply all required anchor bolts, foundation plates, sleeves, nuts, inserts etc. Each equipment skids shall be provided with suitable lifting lugs, eyebolts etc. to facilitate erection & maintenance.

(iv) EXCLUSIONS IN WATER SYSTEM

All the civil & structural works associated for following systems is excluded from contractor's scope,

- 1) Pre-treatment system, Desalination System & effluent treatment system works such as foundations of equipment such as pump (if applicable) / tanks / skids / pipe supports.
- 2) RO reject system works such as reject well, below sea anchor blocks, diffuser block civil works at discharge point.
- 3) Suitable structural sheds required for facilities of all water treatment systems except structural skids for all equipment which will be in scope of equipment vendor.
- 4) Erection of RO reject pipeline laid below sea from reject well to discharge point into sea except mechanical items of suitable MoC required for pipeline anchoring and reject diffusing which will be in scope of equipment vendor.

Further civil & structural works shall be executed by employer in other package based on all input data provided by equipment package vendor.

Note - Civil scope as mentioned in the specification is in Bidder's scope

LIST OF MANDATORY SPARES: MECHANICAL**Gas Engine and Auxiliaries:**

Sl. No.	Item Description	Quantity
Engine Block, Bearings, Oil Sump & Covers		
1.	Camshaft Bearing Bush	20% of total population of all engines.
2.	Cylinder head screw	10% of total population of all engines.
3.	Cylinder liner	20% of total population of all engines.
4.	Anti-polishing Ring	20% of total population of all engines.
5.	Sealing Set	20% of total population of all engines.
6.	Thrust Bearing Kit	40% of total population of all engines.
7.	Main Bearing Kit	40% of total population of all engines.
8.	Sealing kit for Covers & End Covers	20% of total population of all engines.
Connecting Rod & Piston		
9.	Big End Bearing kit	20% of total population of all engines.
10.	Piston	2 nos. X number of engines offered.
11.	Piston Ring set	2 nos. X number of engines offered.
12.	Small End Bearings	20% of total population of all engines.
13.	Connecting Rod Screws	20% of total population of all engines.
14.	Shims	40% of total population of all engines.
15.	Connecting Rod	2 nos. X number of engines offered.
16.	Securing Ring	20% of total population of all engines.
17.	Gudgeon Pin	20% of total population of all engines.
Cylinder Head with Valves		
18.	Cylinder Head	1 no. X number of engines offered.
19.	Starting valve	1 no. X number of engines offered.
20.	Inlet valve (complete)	1 no. X number of engines offered.

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21.	Sealing set for Cylinder head replacement	1 no. X number of engines offered.
22.	Seat ring for inlet valve	1 no. X number of engines offered.
23.	Seat ring for outlet valve	2 no. X number of engines offered.
24.	Sealing set for cylinder head overhaul	1 no. X number of engines offered.
25.	Exhaust Valve (complete)	2 no. X number of engines offered.
Valve Mechanism & Camshaft		
26.	Intermediate Gear	20% of total population of all engines.
27.	Intermediate Gear Bearing	20% of total population of all engines.
28.	Camshaft piece	1 no. X number of engines offered.
29.	Push Rod	20% of total population of all engines.
30.	Protecting pipes	20% of total population of all engines.
31.	Valve tappet	20% of total population of all engines.
32.	Gear	20% of total population of all engines.
33.	Guide pin	20% of total population of all engines.
34.	Screw	20% of total population of all engines.
Turbocharger, charge Air Cooler & Waste Gates		
35.	Charge Air Cooler	20% of total population of all engines.
36.	Turbocharger Bearings	40% of total population of all engines.
37.	Turbocharger Thrust collar	1 nos. X number of engines offered.
38.	Turbine Inlet casings	1 no. X number of engines offered.
39.	Turbocharger Nozzle Ring	1 no. X number of engines offered.
40.	Turbocharger Shroud Ring	1 no. X number of engines offered.
41.	Turbine outlet Casings	1 no. X number of engines offered.
42.	Turbocharger Rotor & Rotating parts	1 no. X number of engines offered.
Ignition Equipment & Gas Manifold		
43.	spark plug	5 nos. X number of engines offered.

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44.	Pre combustion chamber valve	2 nos. X number of engines offered.
45.	Ignition module	1 no. X number of engines offered.
46.	Connection piece/pipes (All types)	1 nos. each type X number of engines offered.
47.	Ignition cable	2 nos. X number of engines offered.
48.	Main Gas admission valves	1 nos. X number of engines offered.
Lubricating oil system		
49.	Pump Sealing Set	1 sets X number of engines offered.
50.	Fuel Feed pipes	1 no X number of engines offered.
51.	Lube oil pump Bearings	20% of total population of all engines.
52.	Lube Oil service Kit	40% of total population of all engines.
53.	Lube Oil Thermostat element	40% of total population of all engines.
54.	Lube Oil Thermostatic element set	1 nos. X number of engines offered.
55.	Lube Oil filter Candles	40% of total population of all engines.
56.	Lube oil pump Driving Gear	1 no. X number of engines offered.
57.	Pre-Lube Oil pump gear	1 nos. X number of engines offered.
Governor		
58.	Governor Drive Bearing	1 set X number of engines offered.
Cooling water System		
59.	LT water pump	1 no. X number of engines offered.
60.	HT water pump	1 no. X number of engines offered.
61.	Driving gear (All types)	20% of total population of all engines
62.	NRV for cooling pumps	20% of total population of all engines
Exhaust System		
63.	Positioner	10% of total population of all engines.
64.	Bellows (All types)	20% of total population of all engines (each type)

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65.	Multiduct service Kit	40% of total population of all engines
Automation & Engine Control		
66.	Knock Sensor	1 no. X number of engines offered.
67.	Temperature Sensor (All types)	20% of total population of all engines (each type)
68.	Control Unit CCM	1 no. X number of engines offered.
69.	Electronic Unit IOM	1 nos. X number of engines offered.
70.	Control Unit	40% of total population of all engines
71.	Engine Safety module	40% of total population of all engines
72.	Pressure Transducer	20% of total population of all engines
73.	Pressure Sensor (All types)	20% of total population of all engines (each type)
74.	I/P Convertor	40% of total population of all engines
75.	Speed Pick-Up (All types)	40% of total population of all engines (each type)
76.	Speed sensor	40% of total population of all engines (each type)
77.	Limit Switch (All types)	20% of total population of all engines (each type)
Starting Air System		
78.	Starting Air Master Valves of each drive type	40% of total population of all engines (each type)
79.	Start Blocking Valve	40% of total population of all engines
80.	Flame Arrestor	40% of total population of all engines
Other spares		
81.	O ring (All types)	20% of total population of all engines (each type)
82.	Sealing sets (All other types not mentioned above)	40% of total population of all engines (each type)
83.	Butterfly valves (All types)	40% of total population of all engines (each type)
84.	Filter cartridge (All types other than Lube Oil filter)	20% of total population of all engines (each type)
85.	Bellows (All types) other than exhaust system	40% of total population of all engines (each type)

Note:

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- Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of all engines. In case the quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.

For example:

Number of engines offered = 6

Number of camshafts bearing bush/ engine = 15

Number of camshaft bearing bush in specification = 20% of total population of all engines

Number of camshaft bearing bush offered in mandatory spares = $15 \times 6 \times 0.2 = 18$

- Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all the items supplied and installed and the breakup for these shall be furnished in the bid

WATER SYSTEM:

A). SWRO (Pressure tube and Membranes)

Sl. No	Name of Items	Unit	QTY
1.	RO Pressure tube complete with membrane assembly	nos.	1
2.	RO membranes	set	1
Note: One set consists of quantity required for complete replacement in one Pressure tube			

B). Energy Recovery (ERU) Units

Sl. No	Name of Items	Unit	QTY
1.	ERU / PX Exchangers	Set	100 % of ERU / PX units installed for one SWRO train/stream
Note: One set consists of quantity required for complete replacement for one Turbo Charger / PX pump as the case may be			

C). Chemical Cleaning System (SWRO Plant)

Sl. No	Name of Items	Unit	QTY
1.	Mixer (Agitator) of Chemical Tanks	NO	1
2.	Chemical Cleaning Pump & Motor	NO	1
3.	Cartridge Filter Element	Set	1
Note: One set consists of quantity required for complete replacement for filter			

D). Flushing Cleaning System (SWRO Plant)

Sl. No	Name of Items	Unit	QTY
1.	Flushing Pump & motor	NO	1

E). Pre- Filtration

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(i) Cartridge Filtration Units (as applicable)

Sl. No	Name of Items	Unit	QTY
1.	Cartridge Filters Element	Set	1
One set consists of quantity required for complete replacement for one filter			

(ii) Pressure Sand (PSF) Filters (as applicable)

Sl. No	Name of Items	Unit	QTY
1.	Inlet Water Distributor Assembly	Set	2
2.	Strainers / Nozzles of Under drain Collector OR Header Lateral Collector (whichever is applicable)	Set	1
3.	Filter Media	LOT	One full charge for one filter + 10%
Note: One set consists of quantity required for complete replacement for one filter			

(iii) Dual Media (DMF) Filters (as applicable)

Sl. No	Name of Items	Unit	QTY
1.	Inlet Water Distributor Assembly	Set	2
2.	Strainers / Nozzles of Under drain Collector OR Header Lateral Collector (whichever is applicable)	Set	1
3.	Filter Media	LOT	One full charge for one filter + 10%
Note: One set consists of quantity required for complete replacement for one filter			

(iv) Filter Air Blowers (Air scouring of PSF & DMF) (as applicable)

Sl. No	Name of Items	Unit	QTY
1.	Filter Air Blower	No	1

F). UF System

I-1) Ultra-filtration (UF) Plant – Membranes			
Sl. No.	Name of Items	Unit	QTY
1)	UF Membrane	No	1

I- 2) UF Feed Pumps (UF Plant)			
Sl. No.	Name of Items	Unit	QTY
1)	UF feed pump	No	1

G). Valves

Sl. No	Name of Items	Unit	QTY
1.	Valves of all types	No	1 numbers of each type / size /material of construction

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H). High Pressure RO Pumps

Sl. No	Name of Items	Unit	QTY
1.	The manufacturers mentioned pump spares recommended for 2 years	Set	1
Note: One set consists of quantity required for complete replacement for one Pump			

J). RO booster pumps (as applicable)

Sl. No	Name of Items	Unit	QTY
1.	The manufacturers mentioned pump spares recommended for 2 years	Set	1
Note: One set consists of quantity required for complete replacement for one Pump			

K). Pumps (1 number of each type/size/MOC for Intake, Pre-treatment, UF, RO, Post-treatment, Dosing, effluent)

Sl. No	Name of Items	Unit	QTY
1.	Horizontal Centrifugal Pumps	No	1
2.	Vertical Pumps (If applicable)	No	1

PLANT UTILITIES:

1.00.00	Compressed Air System:	
1.01.00	Oil free Screw Air Compressor	
1.01.01	Complete H.P Stage with HP element	1 No.
1.01.02	Complete L.P Stage with LP element	1 No.
1.01.03	Motor Bearings	2 Sets
1.01.04	LP stage Pinion	1 No.
1.01.05	HP stage Pinion	1 No.
1.01.06	Air Oil Filter Kit	4 Nos.
1.01.07	After cooler Safety Valve (if applicable)	1 No.
1.01.08	Inter Cooler Safety Valve (if applicable)	1 No.
1.01.09	Oil Pump kit	2 Nos.
1.01.10	After cooler drain valve kit (if applicable)	1 No.

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1.01.11	Inter cooler drain valve kit (if applicable)	1 No.
1.01.12	Air receiver drain/moisture trap	1 No.
1.01.13	'O' Rings for oil cooler	8 Nos.
1.01.14	Moisture separators for Aftercooler (if applicable)	2 Nos.
1.01.15	Moisture separators for Intercooler (if applicable)	2 Nos.
1.02.00	AIR DRYING PLANT (TWIN TOWER TYPE) FOR IA SYSTEM (AS APPLICABLE)	
1.02.01	Pre filter element (Ceramic candle or as applicable)	2 sets
1.02.02	After filter element (Ceramic candle or as applicable)	2 sets
1.02.06	Valves & Valve Actuators (pneumatic/hydraulic)	2 sets
1.02.07	Heater coil for temperature stabilization (for HOC type) (as applicable)	2 sets
1.02.08	Desiccant for Air Dryer	Desiccant for Air Dryer
1.03.00	MEASURING INSTRUMENTS	
	1 Electronic Transmitters	
	(i) Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	2 Nos. of each type and model
	2 Temperature elements	
	(i) RTD's* of each type and length	2 Nos. of each type and length
	ii) Thermocouples of each type like K-type, R-type, metal etc. and length *	2 Nos. of each type and length
	(iii) Thermowell	2 Nos. of each type and length
	(iv) Temperature transmitters (if applicable)	2 Nos. of each type
	4 Process Actuated Switch Devices Includes all types of Pressure, differential pressure, flow, temperature, differential temperature, level switch Devices	2 Nos. of each type and model

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	5 Dew Point meters with sensor	1 No.
	6 Solenoids	2 Nos. of each type
	7 Actuators (if applicable)	1 No.
1.03.00	MICROPROCESSOR BASED/PLC BASED CONTROL/ELECTRONIC BASED CONTRAL PANEL (IF APPLICABLE)	
1	Fully programmed controller of electronic modules of each type (as applicable)	1 No.
2	Power supply module (if applicable)	1 No.
1.04.00	Rotary drum type Air drying plant for Instrument Air system (As applicable)	
	1. Drive assembly consisting of motor, gear boxes, drive shaft & coupling	1 set
	2. Desiccant for Air Dryer	one complete fill of one dryer
1.05.00	Air compressor motor	1 no.

Notes:

1. Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.
2. Any fraction of a item shall mean the next higher integer.
3. Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case the quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.
4. Unless stated otherwise a 'set' means items or sub-items required for each type/size range of the assembly/sub-assembly, required for complete replacement in one unit. It is further, intended that the assembly/sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/sub-assembly, these shall be considered as different types of assembly/sub-assembly.

3.00.00 FIRE DETECTION AND PROTECTION SYSTEM

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY		
1.0	PUMPS	Main Pump	Transfer Pump	Jockey Pump
1.1	Impeller	1 Set	1 Set	1 Set
1.2	Pump bearing (Incl. thrust brg, journal brg., line shaft brg.)	1 Set	1 Set	1 Set
1.3	Pump shaft	1 Set	1 Set	1 Set
1.4	Wearing rings	2 Sets	2 Sets	2 Sets
1.5	Shaft Sleeve	1 Set	1 Set	1 Set
1.6	Bushings	2 Sets	2 Sets	2 Sets
1.7	Bearing housing (if provided)	1 Set	1 Set	1 Set
1.8	Coupling bolts & nuts(with bushes)	1 Set	1 Set	1 Set
	Note: Above quantity/items are required for each type and rating of pumps being supplied under the contract. Further, main pumps mentioned above include both "common hydrant & spray pumps" as well as "fire water transfer pumps".			
2.0	DIESEL ENGINE (1 set means item required for 1 diesel engine)			
	ITEM DESCRIPTION	QUANTITY		
2.1	Sprayers/Injector	1 set		
2.2	Piston rings & sealing rings	2 Sets		
2.3	Exhaust valve assembly	1 Set		
2.4	Springs	1 Set		
2.5	Packings and gaskets	1 Set		
2.6	Fuel oil filter elements with seals	2 Sets		
2.7	Fuel oil filter assembly	1 Set		
2.8	Lub. oil filter elements with seals	2 Sets		
2.9	Scraper rings (if applicable)	1 Set		
2.10	Solenoid coil for fuel valve	1 No.		

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY
2.11	Corrosion inhibitor (if provided)	1 Set
2.12	Big end & small end bearing of connecting rod	1 Set
2.13	Speedometer (if applicable)	1 No.
2.14	Speedometer wire (if applicable)	1 No.
2.15	Rubber hoses of water line with mounting clamps	1 Set
2.16	Cranking starter assembly complete	1 Set
2.17	Lub. oil and fuel oil hoses with end connectors	1 Set
2.18	Water pump belts (if applicable)	2 Sets
	Above quantity/items are required for each type and rating of diesel engine being supplied under the contract	
3.0	FIRE HOSES WITH COUPLINGS	
3.1	7.5m long fire hoses (internal) with end connectors	10% of population
3.2	15m long fire hoses (internal) with end connectors	10% of population
3.3	15m long fire hoses (external) with end connectors	10% of population
4.0	BRANCH PIPES WITH NOZZLES	
4.1	Nozzles with branch pipes & quick coupling ends (internal)	10% of population
4.2	Nozzles with branch pipes & quick coupling ends (external)	10% of population
5.0	DELUGE VALVE ASSEMBLIES (AS APPLICABLE)	
5.1	Complete deluge valve assembly along with internals and accessories	
5.1.1	150 NB	10% of population (Min 1 Set)
5.1.2	100 NB	10% of population (Min 1 Set)

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY
5.1.3	80 NB	10% of population (Min 1 Set)
5.1.4	50 NB	10% of population (Min 1 Set)
5.2	Clapper assembly complete (consisting of clapper seat rubber, screws, etc.)	
5.2.1	150 NB	10% of population (Min 1 Set)
5.2.2	100 NB	10% of population (Min 1 Set)
5.2.3	80 NB	10% of population (Min 1 Set)
5.2.4	50 NB	10% of population (Min 1 Set)
5.3	Solenoid coils	
5.3.1	150 NB	10% of population (Min 1 Set)
5.3.2	100 NB	10% of population (Min 1 Set)
5.3.3	80 NB	10% of population (Min 1 Set)
5.3.4	50 NB	10% of population (Min 1 Set)
6.0	VALVES (GATE/GLOBE/BUTTERFLY/NRV) (AS APPLICABLE)	
6.1	Complete valves	5% of population of each type & size
6.2	Reduction gear operator (Gate/Globe/Butterfly)	10% of population of each type & size
6.3	Flap/door with pin(NRV)	10% of population of the each type & size
6.4	Disc (butterfly/globe)	5% of population of each type & size
6.5	Gate (Gate valve)	5% of population of each type & size
6.6	Stem (all types)	5% of population of each type & size
6.7	Seal rings (all types)	10% of population of each type & size
6.8	Flap rings (NRV)	10% of population of each type & size
6.9	Gaskets	10% of population of each type & size
6.10	Bearing (Butterfly valve)	10% of population of each type & size
6.11	Motorized actuator	1 No. of each size

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY
7.0	BASKET STRAINERS / Y-TYPE STRAINERS for HVW/MVW SYSTEM	
7.1	Strainer elements with O-rings and stiffeners.	
7.1.1	Basket strainer	20% of population of each type & size
7.1.2	Y- Type strainer	20% of population of each type & size
8.0	MVW SPRAY SYSTEM	
8.1	Spray Nozzles	5% of population
8.2	QB Detectors	5% of population
9.0	HVW SPRAY SYSTEM	
9.1	Spray nozzles	5% of population
9.2	QB Detectors	5% of population
10.0	HYDRANT VALVE	
10.1	Hydrant valve complete (internal) single headed with instantaneous female coupling	20% of population
10.2	Hydrant valve complete (external) single headed with instantaneous female coupling	20% of population
10.3	Water monitor sets with nozzle branch pipe etc.	5% of population
10.4	Spindle with nuts of Hydrant valve	10% of population
10.5	Bonnet, gland nut, rubber assembly of hydrant valve	10% of population
10.6	Seat, check nut, washer assembly of hydrant valve	10% of population
10.7	Rubber washer for female coupling	10% of population
10.8	Instantaneous female coupling assembly complete for hydrant valve	10% of population
10.9	Lock pin assembly for hydrant valve	10% of population

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY
11.0	FIRE DETECTORS	
11.1	Multisensor detectors (Addressable)	10 Nos.
11.2	In Indicators assembly for smoke detectors provided in false ceiling (Response indicator)	5 Nos.
12.0	PORTABLE EXTINGUISHERS	
12.1	Water type	10% of each type
12.2	Foam Type	10% of each type
12.3	CO ₂ Type	10% of each type
12.4	Dry Chemical Type	10% of each type
13.0	MOBILE EXTINGUISHERS	
13.1	Foam type	10% of each type
13.2	CO ₂ Type	10% of each type
13.3	Dry Chemical Type	10% of each type
14.0	INERT GAS EXTINGUISHING SYSTEM	
14.1	Nozzles	2 Nos. of each size/type
14.2	Automatic & Manual release system	1 No. of each size/type
14.3	Cylinder valve with safety pressure relief device	1 No. of each size/type
14.4	Flexible hoses (if applicable)	5 Nos. of each size/type
14.5	Solenoid coils	2 Nos. of each size/type
15.0	FIRE ALARM PANEL & REPEATER FIRE ALARM PANEL	
15.1	Power supply modules	2 Nos. of each type & rating whichever is more
15.2	Processor modules, Control modules, loop cards modules, isolator cards	2 No. of each type, whichever is more.
15.3	LCD display of each type unit of panel	1 No.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY
15.4	Interface unit / modules for non-addressable devices, auxiliary / output relay modules, control modules, supervisory control modules and any other electronic modules	10 No. of each type whichever is more.
15.5	Power supervision relay	4 Nos. of each type.
15.6	Fire screen / alarm buzzer	1 No. of each type
16.0	ELECTRICAL	
16.1	Electrical Actuator	10% or 1 No. of each type, model and rating whichever is more.
16.2	Bearings of Motors (HT/LT)	1 Sets for each type & rating
16.3	Motors (HT/LT)	1 No of each type & rating
17.0	CONTROL AND INSTRUMENTATION	
17.1	MEASURING INSTRUMENTS	
17.1.1	Process Actuated Switch Devices : (All types of Pressure, diff. pressure, flow, temperature, level switch devices).	2 Nos. of each type and model
17.1.2	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	2 Nos. of each type and model whichever is more.
17.1.3	Limit switches for isolation valves	2 Nos. of each type
18.0	PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable)	
18.1.1	Valves	1 No. of each type, class, size and model.
18.1.2	2 way, 3 way, 5 way valve manifolds (as applicable)	2 No. of each type, class, size and model.
18.1.3	Fittings	5 No. of each type, class, size and model whichever is more.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	ITEM DESCRIPTION	QUANTITY
19.0	CABLES	
19.1.1	Pre-fabricated cable with connectors (as applicable)	1 No. of each type, size and model.
19.1.2	Other cables (including core cable, short-term fire proof cable, fiber optic cables, etc.)	500 meters of each type, pair/ core and size
20.0	PLC CONTROL SYSTEM	
20.1.1	Power Supply Unit	1 No. of each type and model,
20.1.2	Electronic modules (I/O modules, communication modules and any other module used in the system)	1 No. of each type and model, whichever is more.
20.1.3	Central Processor Unit	1 No. of each type and model
20.1.4	Interconnecting Cables (as applicable)	10% of each type & size
20.1.5	Cooling Fan in PLC system / cabinet	2 Nos.
20.1.6	Graphical Interface Unit	1 No.
21.0	24V – DC POWER SUPPLY SYSTEM	
21.1.1	CTs, CVTs, VTs, chokes, AC/DC isolators, contactors, timers, relays (as applicable)	2 Nos. of each type and rating
21.1.2	Fuses of each type and rating	2 Nos. of each type and rating
21.1.3	Fuse free Circuit breakers	2 Nos. of each type and rating
21.1.4	Electronic modules of all types	1 No. of each type
21.1.5	Cooling Fans (as applicable)	1 No. of each type
21.1.6	Relays of all types including overload relays (as applicable)	2 Nos. of each type and rating
21.1.7	Batteries	2 nos. of each type & rating

4.00.00 **VENTILATION SYSTEM**

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

1.0	Filters	10% of each type & size
2.0	Motor for supply air fan/exhaust air fans/ roof extractors	1 no. each type and rating

Notes :

1. Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.
2. Any fraction of a item shall mean the next higher integer.
3. Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case the quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.
4. Unless stated otherwise a 'set' means items or sub-items required for each type/size range of the assembly/sub-assembly, required for complete replacement in one unit. It is further, intended that the assembly/sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/sub-assembly, these shall be considered as different types of assembly/sub-assembly.

LIST OF MANDATORY SPARES**ELECTRICAL:**

Sr. No.	Description	Quantity
1.	GIS	
1.00.00	Gas Insulated Switchgear	
1.01.00	SF6 gas pressure Relief Devices, 3 Nos. of each type	2 Sets
1.02.00	SF6 Pressure gauge with coupling device cum switch or density monitors and pressure gauge, as applicable (1 no. of each type)	1 Set
1.03.00	Rubber gaskets, "O" Rings and seals for SF6 gas, including Circuit Breaker, Disconnecter and other GIS equipment's (6 no. of each type)	1 Set
1.04.00	Molecular filter for SF6 gas with filter bags(1set=20% total quantity of absorber bags used in GIS)	1set
1.05.00	SF6 gas cylinder of 50Kgs / cylinder (20% of total Gas used in GIS)	1set
1.06.00	Covers with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of the compartment	
1.06.01	For 1 phase enclosure (3 Nos. of each type)	1 Set
1.06.02	Locking device to keep the Dis-connectors and Earthing switches in close or open position in case of removal of the driving mechanism (If applicable)	3 No.
1.06.03	Bus support insulator of each type for single phase enclosure (6 Nos. of each type)	1 Set
1.06.04	SF6 to air bushing for 1 phase enclosure	2 Nos.
1.06.05	Spares for Local control cabinet: MCB, fuses, timers, Aux Relay of each type & rating, terminals of each type (Set)	1 No.
1.06.06	All types of Corona shield (3 Nos. of each type)	1 Set
1.06.07	Windowscope/ Observing window, 3 Nos. of each type (if applicable)	1 Set
1.07.00	Circuit Breaker	
1.07.01	Complete Circuit Breaker 1 phase pole of each type & rating complete with interrupter, main circuit and enclosure with operating mechanism	3 Sets
1.07.02	Not Applicable	
1.07.03	Trip Coil assembly with resistor as applicable, 3 Nos. of each type	2 Sets
1.07.04	Closing Coil assembly with resistor as applicable, 3 Nos. of each type	2 Sets
1.07.05	Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating(If applicable)	1 Set
1.07.06	Closing assembly/ valve, 3 nos. of each type (If applicable)	2 Sets
1.07.07	Trip assembly/ valve, 3 nos. of each type (If applicable)	2 Sets
1.07.08	Aux. switch assembly, 3 Nos. of each type	1 Set
1.07.09	Operation counter, 3 nos. of each type	1 Set
1.07.10	Rupture disc, 3 Nos. of each type (If applicable)	1 Set

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

	Spare of pneumatic/spring/hydraulic operated mechanism (as per Main Supply) 1)Spare of pneumatic operated mechanism(complete) a. Motor for compressor – 1 no. b. Pressure switch and valve etc – 1 no. of each type 2)Spare of spring operated mechanism(complete) a. Motor – 1 no b. Limit switch etc– 1 no. of each type 3)Spare of hydraulic operated mechanism(complete) a. Motor – 1 no. b. Limit switch – 1 no. of each type	1 Set for each type of Circuit Breaker
1.08.00	Disconnecter	
1.08.01	Complete set of 3 nos. of single phase disconnector including main circuit, enclosure and driving mechanism	1 Set
1.08.02	High speed/ fast acting fault making grounding switch, 3 nos. of single phase of each rating, including main circuit, enclosure and driving mechanism	1 Set
1.08.03	3 nos. of single phase Earthing switch including main circuit, and driving mechanism	1 Set
1.08.04	Not Applicable	
1.08.05	Not Applicable	
1.08.06	Open/ close contactor assembly, timers, key interlock for one complete (3phase) disconnector and earthing switch of each type & rating (if applicable)	1 Set
1.08.08	Limit switches and Aux. switches for complete 3-phase equipment	
	a) For Disconnector	3 Sets
	b) For earth switch	1 Set
	c) For High speed earth switch	1 Set
1.08.09	Relays. Power contactors, resistors, fuses, push buttons, timers & MCBs (Complete for one 3 phase equipment) if(If applicable)	
	a)For Disconnector	3 Sets
	b)For earth switch	1 Set
	c)For high speed earth switch	1 Set
1.09.00	Current Transformer	
1.09.01	Complete CT, as applicable, with enclosure, as applicable, 1 no. of each type & rating	1 Set
1.10.00	Voltage Transformer	
1.10.01	Gas Insulated complete VT with enclosure	1 No.
1.11.00	SF6 Gas Insulated Surge Arrestor with enclosure	3nos
2	Not applicable	
3	Not Applicable	
4	Not Applicable	
5.	SAS Including GRPs	
1.	Bay Control unit (complete with all components)	2 Nos.
2.	Numerical Relays comprising various bay protection units, Bus Bar and Islanding Scheme	1 No. of each type
3.	Numerical Relays comprising GRP	1 No. of each type
4.	Cards/modules of Generator Disturbance Recorder, Line DR (if stand-alone)	1 No. of each type
5.	Energy Meter (ABT meter) class :0.2s	1 no. of each type
6.	Operator work station (OWS) along with software, monitor, mouse, keyboard, printer etc.	1 No.
7.	Complete Network Controller / Server along with software	1 No.
8.	Complete Programming station along with software, monitor etc.	1 No.
9.	LAN switches (if included in main package)	1 No. of each type

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

10.	Fuses	10nos of each type and rating
11.	Terminal Blocks	5 nos. of each type, make, model and rating
12.	Interface cables containing standard length of each type of cable and its connector for each type of peripheral	2 Sets
13.	MCBs	1no of each type, make and model used in the system
14.	RELAYS OTHER THAN NUMERICAL RELAYS	1no of each type of total population (min 1 no.)
15.	GATEWAYS	1 no. of each type
16.	MODEM (IF APPLICABLE)	1 no. of each type
17.	LIU OF OFC INCLUDING NECESSARY CONNECTORS	1 no. of each type
18.	TRANSDUCERS	1 no. of each type
19.	AUXILIARY CT/PT	1 no. of each type
20.	GPS EQUIPMENT	1 set comprises hardware Modules of each type

2	MV Busduct	
1	11 kV Busduct	
	a. Support insulators	25 Nos.
	b. Three phase set of flexible terminal connectors for switchgear end of each type & rating	1 set
	c. Three phase set of flexible terminal connector for transformer end of each type & rating	1 set
	d. Seal off bushings of each type & rating	3 nos.
2	3.3 kV Busduct (if applicable)	
	a. Support insulators	25 Nos.
	b. Three phase set of flexible terminal connectors for switchgear end of each type & rating	1 set
	c. Three phase set of flexible terminal connector for transformer end of each type & rating	1 set
	d. Seal off bushings of each type & rating	3 nos.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

NOTE: ONE SET MEANS COMPLETE REQUIREMENT OF ONE PHASE,
WHEREVER NOT SPECIFIED

3. MV Switchgears (33kV / 11kV / 6.6kV / 3.3kV) & PCM

S.No.	Item Description	Quantity
1	Breaker of each rating	3 nos. of each type & rating
2	Numerical relays	5 Nos. of each type
3	Aux. Relays/ Lock out relays/ Timers/ Coupling Relays (if applicable)	10 Nos. of each type
4	Energy meter of each type & range (if applicable)	1 Nos. of each type
5	Current transformer of each type & ratio	3 Nos. of each type
6	Potential transformer of each type & ratio	3 Nos. of each type
7	Vacuum Contactors with HRC fuses	2 Sets (One set = Three fuses)
8	Surge arresters	3 Nos. each rating
9	Circuit Breaker Auxiliary contact assembly	6 Nos. of each type and rating
10	Busbar support insulator	12 Nos.
11	Moving contact assembly of each rating (One set means complete replacement for one breaker)	2 SET
12	Stationary fixed contact of each rating.(One set means complete replacement for one breaker)	2 SET
11	Numerical Relay Networking System (Switchgear SCADA)	
	a. Ethernet Switch of each type / model / configuration (mounted in Switchgears / Data concentrator Panels)	10% of total quantity (minimum 1No.)
	b. FO Cable terminal equipment of each type such as LIUs along with associated Patch cords & connectors	10% of total quantity (minimum 1No.)
	c. Power supply modules of each type & rating (mounted in Switchgears / Data concentrator Panels, as applicable)	10% of total quantity (minimum 1No.)
	d. Maintenance tools and accessories for maintenance of HT Switchgear	2 Nos.

4. LT Switchgears & LT Busducts

S. No.	Item Description	Quantity
1	Complete breaker of each rating	10 Nos.
2	Numerical Relays of each type	5 Nos.
3	Auxiliary Relays of each type	10 Nos
4	Horizontal busbar support Insulators	12 Nos
5	Vertical busbar dropper support insulators	12 Nos
6	Current transformer of each type & ratio	3 Nos.
7	Voltage transformer of each type & ratio	3 Nos.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

8	Control supply transformer of each type & rating	3 Nos.
9	Power Contactor of each type and rating	10 Nos.
10	Coil for above contactor for each type and rating	10 Nos.
11	MCCBs (equally divided for all ratings)	40 Nos.
12	MPCBs (equally divided for all ratings)	40 Nos.
13	Closing coil of each type of each rating	10 Nos.
14	Trip coil of each type of each rating	10 Nos.
15	Aux contact set of each type and Rating	6 Sets.
16	Fixed contact set of each type & rating	3 Sets.
17	Moving contact set of each type & rating	3 Sets.
13	Maintenance tools and accessories for maintenance of LT MCC	2 Nos.

5. DC BATTERY

S. No.	Item Description	Quantity
1	Complete dry cell	5% or 10 Nos. whichever is more for each set of battery bank
2	Inter-cell connectors with Hardware	5% or 5 Nos. whichever is more for each set of battery bank
3	BHMS Spares	5% of installed capacity

6. BATTERY CHARGER

S. No.	Item Description	Quantity
1	Set of Electronic Cards / Modules	1 set of each type & rating
2	Set of Auxiliary relays	1 set of each type & rating
3	Set of Fuse Links and Glass Fuses	3 set of each type and rating
4	3 phase Rectifier Bridge complete assembly	1 set of each type and rating
5	Rectifier Transformer	1 No. of each type & rating
6	Control Transformers	1 No. of each type & rating

7. CHIMNEY LIGHTING – Aviation Obstruction Lighting

a.	Power Supply Card	6 nos
b.	Electronic Flasher Card	3 Nos
c.	Photocell Control Unit	3 Nos
d.	Spare lamp/tube with holder for Aviation Obstruction Lighting fixture	12 Nos

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

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LIST OF MANDATORY SPARES for oil filled transformers

S. No	ITEMS DESCRIPTION	GT	Aux. Trans. (for each rating)
1.	HV Bushing with metal parts and gaskets (See Note 1)	3 No.	3 No.
2.	HV Neutral bushing with metal parts and gaskets	2 No.	1 No. (if applicable)
3.	Not used	-	-
4.	LV bushing with metal parts and gaskets (See Note 1)	3 No.	3 No.
5.	LV Neutral bushing with metal parts and gaskets	-	1 No.
6.	WTI with contacts	2 No.	1 No.
7.	OTI with contacts	2 No.	1 No.
8.	Pressure relief device	2 No.	1 No. (if applicable)
9.	MOG	2 No.	1 No.
10.	Buchholz relay complete	2 No.	1 No.
11.	Oil surge relay	2 No.	-
12.	Set of gaskets (See Note 2)	1 Set	1 Set
13.	Set of valves	2 No. of each type/size	2 No. of each type/size
14.	Not used	-	-
15.	Not used	-	-
16.	Not used	-	-
17.	Set of OLTC/OCTC contacts	1 Set (OLTC)	-
18.	Air cell for conservator	1 No.	1 No. (if applicable)
19.	Not used	-	-

Note 1: Each mandatory spare RIP bushing shall be provided with suitable "stand".

Note 2: 1 set consists of gaskets required for 1 no. transformer for the following

- (a) protection and monitoring devices
- (b) cooler circuit
- (c) largest inspection cover, if applicable
- (d) HV/LV turret, if applicable
- (e) OLTC inspection cover, if applicable

Note 3: 1 set consists of quantities required for 1 complete transformer.

ANNEXURE: ICMANDATORY SPARES LIST FOR CONTROL AND INSTRUMENTATIONS**1.00.00 CONTROL SYSTEM**

SI No	ITEM	QUANTITY
1.	HMI Devices	
A)	Workstation	
	(i) OWS with licensed software	1 no. of each type and model
	(ii) Server / Programming station with licensed software	1 no. of each type and model
	(iii) Keyboard	2 no. of each type and model
	(iv) Mouse	4 no. of each type and model
B)	Network Components	
	(i) Switch/repeaters/hubs/firewalls for PLC/ DDCMIS including Station LAN etc.	2 nos. of each type and model
	(ii) Any other device/equipment not covered under above items but required to make system complete.	2 nos. of each type and model
2.	Cables and Connectors.	
	(i) Prefab interconnecting cables with connectors	2 no. of each type and length.
	(ii) System bus cable with connectors	2 no. of each type and length.
	(iii) I/O bus cable with connectors for remote I/O units	2 no. of each type and length.
	(iv) Loose Connectors	5 nos. (sets) of each type
3.	Power Supply Modules & Power Packs for control system	20% or 2 nos. of each type model and rating, whichever is more.
4.	Electronic modules of each type and model for control system, Data communication system, Master and Slave Clock etc. (This shall include all type of cards like I/O cards, Remote I/O cards, communication/Interface cards,	20% or 2 Nos of each type, model and rating whichever is more

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	controller cards, CPU module or Card, logic cards, etc.)	
5.	Bus coupler/Interface hardware / other communication devices.	20% of each type and model or minimum 2 nos which ever is more.
6.	Relays	10% of each type and model or minimum 2 nos which ever is more
7.	Isolators	10% of each type and model or minimum 2 nos which ever is more
8.	Batteries used for battery backup of RAMs (If applicable)	10% of each type and model or minimum 2 nos whichever is more
9.	Fuses	200 % of each type and rating
10.	Cooling fans for Power supply and cabinets.	10 % of each type and model
11.	Intelligent mini-UPS for workstation server, PCs, L3 switch. (if applicable)	1 no. of each size and rating

2.00.00

MEASURING INSTRUMENTS

Sl. No.	ITEM	QUANTITY
1 AAQMS (SO₂, NO_x, CO, Dust monitoring)		
(i)	Analyzer for SO ₂ , NO _x , CO, Dust monitoring	1 no. complete instrument of each type and model
(ii)	Electronic Card Assemblies/PCBs, power supply modules	10% of each type and model
(iii)	Set of Gaskets/"O" rings/ seals	200% of each type, model, rating and size
(iv)	Heater Assembly-	20% of each type and model
(v)	Temp. Sensor	20% of each type and model
(vi)	Solenoids	2 nos. of each type, model and rating
(vii)	Filters, light source, etc.	100% of each type, model and rating
(viii)	Calibration gases, calibration cell and other consumables for calibration: - of all types and ranges.	One year supply.
(ix)	Pump repair kit (If applicable)	One set
2. (I) CEMS (SO_x, NO_x, CO): -		
(a)	Analyzer for SO _x , NO _x , CO	1 no complete instrument of each type and model.
(b)	Flue gas flow measurement	1 no. complete instrument along with sender/receiver unit

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(c)	Electronic card assembly/ PCBs, moisture/condensate monitor, power supply modules	10% of each type, model and rating
(e)	Set of gaskets/O-rings/ seals	200% of each type, model, rating and size
(f)	Temp. Sensor	20% of each type and model
(g)	Heater assembly, Cooler assembly	20% of each type and model
(h)	Complete Probe with shield assembly (Not applicable for Insitu- path)	1 no. of each type and model
(i)	Solenoids	2 nos. of each type, model and rating
(j)	Filters, light source, sensor, detector, etc.	200% of each type, model and rating
(k)	Calibration gases, Calibration cell and other consumables for calibration: - of all types and ranges.	One year supply
(l)	Heavy duty blower assembly	1 no. of each type, size and rating.
(m)	Rotameter/Air flow meter	2 nos. of each type, model and rating
3	Measuring Instruments	
a)	Transmitters	
(i)	Transmitters of all type, range and model no. (For the measurement of Pressure, differential pressure flow, level, temperature etc.)	10%- of each type and model
(ii)	Interface modules at field (between field transmitter & DDCMIS) like Zener barrier, power supply isolator, isolater (as applicable) etc.	10% of each type
b)	Temperature elements	
(i)	RTD's	10% of each type and length
(ii)	Thermocouples	10% of each type and length

3.00.00 POWER SUPPLY SYSTEM

3.01.00 Uninterrupted Power supply (UPS) System including Static Switches for Sub Distribution

(i)	Silicon controlled thyristors, diodes and power transistors.	100 %
(ii)	Capacitors	1 set
(iii)	CT's, CVT's VT's chokes, AC/DC isolators, contactors, timers, relays.	10% of each type and rating.
(iv)	Fuses of each types and rating	200%

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(v)	Fuse free Circuit breakers	5% of each type and rating
(vi)	Electronic modules	10% of each type
(vii)	Indication lamps	100% of each type
(viii)	Lamp holders with series resistor, if any	10% of each type
(ix)	Cooling Fans	2 nos. of each type
(x)	Digital/analog panel meters/ indicators	1 no. of each type
(xi)	Relays of all types including overload relays.	10%
(xii)	Static Switch	10% or minimum 1 no (whichever is higher) of each type and rating

4.00.00 INSTRUMENTATION CABLE, CONTROL CABLE, INTERNAL WIRING

SI No	ITEM	QUANTITY
(i)	Prefabricated cable of each type (other than DDCMIS application) (if applicable)	10% of installed quantity.
(ii)	Prefabricated cable connector (other than DDCMIS application) (if applicable)	10% of each type and model
(iii)	Other cables (Instrumentation and Control cable)	5% or 500 mtrs whichever is more for each type, pair and size of actual supplied quantity.

5.00.00 CCTV

SI No	Item	Quantity
(i)	Camera	10% of each type or 2 nos. which ever is more
(ii)	Full function keyboard & Joystick	1 no.
(iii)	Client Workstations with monitor	1 no.
(iv)	Network Switches	10% of each type, make, model etc.
(v)	Camera/Database Server	1 no.
(vi)	Mechanism motors	10%
(vii)	Media Converters	10%
(viii)	Camera mounting arrangement.	10% of each type or 2 nos. which ever is more

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6.00.00 PROCESS CONNECTION PIPING (FOR IMPULSE PIPING/TUBING, SAMPLING PIPING/TUBING AND AIR SUPPLY PIPING AS APPLICABLE)

Sl. No.	ITEM	QAUNTITY
(i)	Valves of all types	10%
(ii)	2 way, 3 way, 5 way valve manifolds	10% of each type, class, size and model
(iii)	Fittings	10%
(iv)	Purge meters	5% of each model
(v)	Filter regulators	20% of each model

7.00.00 ELECTRIC ACTUATORS

Sl. No.	ITEM	QAUNTITY
(i)	Actuator	1 no. of each type & rating
(ii)	Electronic PCB of all types	10% of each type & model
(iii)	Absolute Encoder (replaceable part)	5% of each type & model
(iv)	Electronic Torque sensor	5% of each type & model

8.00.00 CONTROL VALVES, ACTUATORS AND ACCESSORIES

Sl. No.	ITEM	QAUNTITY
(i)	Pneumatic Control Valve actuator assembly	10% or 1 Nos. of each type, model and rating, whichever is more.
(ii)	Diaphragms, O' rings, seals etc.	100% of all types, make etc.
(iii)	Pressure Gauges of all types, make, rating etc.(if applicable)	10% or 2 nos. of each type whichever is more.
(iv)	Solenoid valves (if applicable)	10% or 2 nos. of each type whichever is more.
(v)	Control valve positioners/smart positioners and its accessories	10% or 2 nos. of each type, model and rating, whichever is more.
(vi)	E/P converters (if applicable)	10% or 2 nos. of each type, model and rating, whichever is more.

9.00.00 PUBLIC ADDRESS SYSTEM

9.01.00 Call Stations & Amplifiers

Sr. No.	Item	Quantity
(i)	Call station for outdoor area with amplifier	10 % of each type, make, model etc.
(ii)	Call station for indoor area desktop mounting type with amplifier	10 % of each type, make, model etc.
(iii)	Master Control Unit (MCU)	10 % of each type, make, model etc.
(iv)	Portable Call station with minimum 2 mtrs connecting cable.	10 % of each type, make, model etc.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

(v)	Standalone amplifier	10 % of each type, make, model etc.
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9.02.00

Loudspeakers

Sr. No.	Item	Quantity
(i)	Outdoor Industrial horn type loudspeaker	10 % of each type, make, model etc.
(ii)	Indoor wall mounted cone type loudspeaker	10 % of each type, make, model etc.

- Note:
1. Refer Part-A Sub-Section-VI (Mandatory Spares) for general requirements and interpretation of various terms and conditions.
 2. In case the main population of any item is only one no., then the spare quantity shall also be one no., overriding requirements indicated in above clauses.
 3. Wherever the quantity is given only in percentage, the spare quantity shall be distributed into various ranges/size/rating/type (as the case may be) in the same proportion of the main population. For the quantities coming less than 1, shall be treated as 1 only.
 4. C&I mandatory spares if covered under other chapters of Section VI, Part F of technical specification are not required to be repeated.

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ANNEXURE ID

MANDATORY SPARES FOR ROOF TOP SOLAR PV

Bidder shall maintain following mandatory spares, consumables & various components of Solar PV plant for smooth running . The bidder shall also mention the source of supply.

1. Solar PV module - 1% of total population
2. Inverter - 1 No of string inverter of highest size of supplied capacity.
3. Flexible Solar DC cable – 500 m.
4. DC side Surge Arrestor, If applicable – 1 No

Wherever quantity has been specified as percentage (%) and the quantity of mandatory spares works out to be a fraction, the same shall be rounded off to next higher whole number.

LIST OF TOOLS & TACKLES

A. Mechanical:

S.No.	Item Description	Size	Qty.
1.	Box wrenches	10-11	02 nos.
2.	Box wrenches	12-14	02 nos.
3.	Box wrenches	13-17	02 nos.
4.	Box wrenches	19-22	02 nos.
5.	Box wrenches	30-32	02 nos.
6.	Box wrenches	24-27	02 nos.
7.	Engineers wrench	10-11	02 nos.
8.	Engineers wrench	12-14	02 nos.
9.	Engineers wrench	13-17	02 nos.
10.	Engineers wrench	19-22	02 nos.
11.	Engineers wrench	24-27	02 nos.
12.	Engineers wrench	30-32	02 nos.
13.	Engineers wrench	36-41	02 nos.
14.	Engineers wrench	46-50	02 nos.
15.	Combination wrench	AL36	02 nos.
16.	Key for hexagon socket screw	4	02 nos.
17.	Key for hexagon socket screw	5	02 nos.
18.	Key for hexagon socket screw	6	02 nos.
19.	Key for hexagon socket screw	8	02 nos.
20.	Key for hexagon socket screw	10	02 nos.
21.	Key for hexagon socket screw	12	02 nos.
22.	Key for hexagon socket screw	14	02 nos.
23.	Key for hexagon socket screw	17	02 nos.
24.	Bit, hexagon socket screw ½" squ	6	02 nos.
25.	Bit, hexagon socket screw ½" squ	8	02 nos.
26.	Bit, hexagon socket screw ½" squ	10	02 nos.
27.	Bit, hexagon socket screw ¾" squ	14	02 nos.
28.	Bit, hexagon socket screw ¾" squ	19	02 nos.
29.	Socket wrench ½" square drive	10*12.5	02 nos.
30.	Socket wrench ½" square drive	13*12.5	02 nos.
31.	Socket wrench ½" square drive	17*12.5	02 nos.
32.	Socket wrench ½" square drive	19*12.5	02 nos.
33.	Socket wrench ½" square drive	24*12.5	02 nos.
34.	Socket wrench ½" square drive	13*12.5L	02 nos.
35.	Socket wrench ½" square drive	24*12.5L	02 nos.
36.	Socket wrench ¾" square drive	41*20L	02 nos.
37.	Socket wrench ¾" square drive	30*20	02 nos.
38.	Torque wrench	20-100Nm	02 nos.
39.	Torque wrench	75-400Nm	02 nos.
40.	Torque wrench	150-800Nm	02 nos.
41.	Ratchet handle with ¾" in square	¾"-553	02 nos.
42.	Ratchet handle with ¾" in square	B12.5	02 nos.
43.	Speed brace	B12.5*500	02 nos.

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44.	Extension bar	B12.5*250	02 nos.
45.	Adapter socket wrench	A20*12.5	02 nos.
46.	Swivel head	¾"-554	02 nos.
47.	Pliers for securing ring	A40	02 nos.
48.	Screw driver	2*12	02 nos.
49.	Tool locker	TLR-1200	02 nos.
50.	Stud remover	5-20	02 nos.
Tools for main bearing:			
51.	DOG for main bearing		01 no.
52.	DOG for thrust bearing		01 no.
Tools for cylinder liner:			
53.	Lifting tools		01 no.
54.	Honing tool for deglazing of cyl. Liner		01 no.
55.	Tool for removing antip. ring		01 no.
56.	Grinding tool for liner and cyl. Head S+		01 no.
Tools for piston:			
57.	Lifting tool for piston		01 no.
58.	Piston ring pliers 320		01 no.
59.	Fitters tool for piston		01 no.
60.	Pliers for retaining rings ZGJ-5+ZSJ51		01 no.
61.	Jack for piston		01 no.
Tool for connecting rod:			
62.	Mounting and Dismounting tools for conn. Rod .Big		01 no.
63.	Tool for connecting rod		01 no.
64.	Limitter for piston		01 no.
Hydraulic tightening tools for connecting rod:			
65.	Hydraulic tighten. Tool for M27*2 screw		02 nos.
66.	Mounting tool 5033 4V80D0032		01 no.
67.	Pin for tight of M27*2 nuts		01 no.
68.	Assembly tool for intermediate gear		01 no.
Tools for cylinder head:			
69.	Lifting tool		01 no.
70.	Device for engine valves 5032 1V12		01 no.
71.	Turning tool for grinding of valves		01 no.
72.	Extractor for start and inj. Valve		01 no.
73.	Adapter		01 no.
74.	Valve clearance feeler		01 no.
75.	Extraction tool for injection valve		01 no.
76.	Extraction mandrel for valve guide		01 no.
77.	Lifting tool for rocker arm assembly		01 no.
Tools for injection equipment(If Applicable):			

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78.			
79.	Socket 05020036(56-36) 36		01 no.
80.	Open-end wrench(change over)		01 no.
81.			
82.	Moving tool 5004 2V35A1568		01 no.
83.	Lifting device 6002 2V16F0124		01 no.
84.	Tool for conn. Piece flan. Screw		01 no.
85.	Extraction tool 6002 2V16L0644		01 no.
86.	Part digital depth gauge W. data O 150MM		01 no.
87.	Base single extension base 180MM		01 no.
88.	Bracket for nozzle removal		01 no.
89.			
Tools for hydraulically tension M42 screw connection:			
90.	Hydraulic tightening tool M42		02 nos.
91.	Distance bush for hydraulic tool		02 nos.
92.	Pin for tensioning tool		01 no.
93.	Extraction for M42 stud		01 no.
94.	Distance sleeve for tightening of		02 nos.
95.	Elbow union for tightening tool		02 nos.
Tools for hydraulically tensioned M80 screw connection:			
96.	Hydraulic tool for camshaft and interme		01 no.
97.	Support 5001 2V13L0113		01 no.
98.	Mounting and removal Tool F. Stud		01 no.
99.	Fastening arm for hydraulic Tool M80X6		01 no.
100.	Lifting device for hydraulic tool		01 no.
Tools for hydraulically tensioned M60 screw connection:			
101.	Hydraulic tightening tool		02 nos.
102.	Hydraulic cylinder		04 nos.
103.	Extractor tool		01 no.
104.	Pin		01 no.
105.	Lifting tool		01 no.
106.	Lifting tool for hydraulic cylinder		01 no.
High pressure pump(1000 bar):			
107.	Hydraulic pump 1000 bar		01 no.
108.	Hose assembly for tightening tool L=820		02 nos.
109.	Hose assembly for tightening tool		03 nos.
Low pressure pump(150 bar):			
110.	Low pressure handpump		01 no.
111.	Hose, low pressure pump		02 nos.
Miscellaneous tools:			
112.	Mounting tool		01 no.

SCOPE OF SUPPLY & SERVICES, TERMINAL POINTS AND EXCLUSIONS

113.	Hydraulic cylinder		01 no.
114.	Pressure testing device		01 no.
115.	Deflection indicator		01 no.
116.	Locking plate		08 nos.
117.	Securing pin		16 nos.
118.	Lifting eye bolt		01 no.
119.	Lifting eye bolt		01 no.
120.	Wrench		01 no.
121.	Inhex socket 17X20(59-17)		01 no.
122.	Ring spanner		01 no.
123.	Extractor plate		01 no.
124.	Extractor		01 no.
125.	Tool		01 no.
126.	Mounting tool		01 no.
127.	Pressure testing device		01 no.
128.	Pump		01 no.

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B. ELECTRICAL TESTING EQUIPMENT AND T&P

S. No.	Item Description	Quantity
1	Oil BDV Measurement kit- Automatic oil testing unit for checking BDV of transformer oil upto 80kV.	Refer Sub Chapter II-E-13 Volume II, Sec VI Part B
2	Oil tan delta and resistivity measurement kit.- Suitable for measurement of Volume resistivity, Di-electric constant, Watt loss, loss factor with elevated temperature read out for transformer oil.	
3	Capacitance & Tan delta meas. Equip. (with cables etc.)- 0-10kV (Fully Automatic)	
4	Winding Resistance measurement kit	
5	Off Line laboratory model oil DGA kit	
6	Oil tanker, wheel mounted, 5 kL capacity	
7	Fully automatic AC high voltage test kit, upto 25 kV/ 5A suitable for testing Generator and associated busduct.	1 no.
8	Fully automatic DC high voltage 0- 40 KV/ 50 mA test kit	1 no.
9	Dual channel digital storage oscilloscope with Fast Fourier Transform analysis	1 no.
10	Step voltage injector for testing of Excitation system with voltage range from 0 - 1.5 Volts and voltage selectable in steps of 0.1 Volts.	1 no
11	One complete set of torque wrenches of different sizes	1 no.
12	Hydraulic crimping tools with dies	1 set
13	Fully automatic portable micro-ohmmeter, winding resistance measurement kit for generator.(stator and rotor)	1 no.
14	Portable earth resistance measurement kit based on three spike method	1 no.
15	Portable earth resistance measurement kit based on Staveless method(clamp on type)	1 no.
16	Precision grade 0.1 KV- 5 kV motorised megger	1 no.
17	Bearing puller based on induction heating method suitable till Generator rating	1 no.
18	Fully automatic Vacuum bottle testing kit	1 no.
19	Motor greasing device	1 no.
20	Fully automatic Battery impedance measurement test kit capable of measuring and storing specific gravity of acid, temperature of cell etc. with data storage facility.	1 no.
21	Fully automatic battery discharge unit	1 no.
22	Fully automatic portable cable fault locator	1 no.
23	Precision grade Digital Phase angle meter	2 nos.
24	Precision grade 3 1/2 digit digital multimeter with suitable clamp on meters	6 nos.
25	Precision grade clamp on current measurement kit suitable for measuring spill current in mA accurately.(Current range:0- 100 mA)	3 nos.
26	Portable panel cutting machine.	2 nos.
27	Complete set of screw drivers and nut drivers suitable for working in relay panels	3 nos.
28	Fully automatic digital megger (0-15 kV)	2 nos.
29	Maintenance tools and accessories for maintenance of LT MCC	2 nos.
30	Maintenance tools and accessories for maintenance of HT MCC	2 nos.

PART-A
VOLUME – IV
PLANT PERFORMANCE AND DESIGN
PHILOSOPHY

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

1.00.00 GENERAL

The plant shall be complete in all respects and shall include all the equipment, systems and plant services necessary for safe, reliable and trouble free operation in the operating regimes and duty conditions specified in the Technical Specifications. Design of the plant shall take into account convenience of access, ease of maintenance, operational flexibility, the latest applicable statutory regulations/ safety codes and the climatic conditions particular to the site.

Broad design requirements for the power plant are as follows:

- a. Plant Type : RLNG fired open cycle Engine Power plant.
- b. Engine : Suitable for 50 Hz Electric Power Generation Applications.
- c. Design Reference conditions for guaranteed performance : As per Clause 3.01.01, Volume-IV, Part A.
- f. Operating Capability : Base Load, Cyclic Loading and Daily start/stop
- g. Fuel : RLNG
- h. NOx Emission level : As per Clause 6.02.00, Volume-IV, Part A.
- i. Cooling Water Cycle : Close cycle with Radiator cooling

Detailed design requirement for the plant is specified in this Volume. Detailed equipment specification shall be as per the respective Chapters of Part – B of Technical Specifications.

2.00.00 PLANT CONFIGURATION AND PLANT CAPACITY

Configuration: Genset modules to meet plant net capacity as 50 MW \pm 10% (ie. 45 MW to 55 MW) with 4 to 11 identical units.

Bids with total plant net capacity less than 45 MW shall not be considered for evaluation and shall be rejected & any net output in excess of 55MW shall not be taken into consideration for evaluation.

3.00.00 PERFORMANCE CRITERION

3.01.00 Reference Conditions for Guaranteed Performance

3.01.01 Guaranteed Performance of each Genset Module shall be at the following reference conditions:

- a. Fuel : RLNG; Composition as per the 'Typical' composition given in Annexure – IA of Project Information (Vol.- II). Further, Bidder may calculate Methane number and measure Heating value in presence of NVVN's representative for calculating the guarantee performance.
- b. Power Factor : 0.85 (lagging)

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

c. Frequency : 50 Hz

Note : Bidder shall use **EN 16726:2015 (E)** for calculating the Methane number for deciding reference point of correction curve as well as for calculating the Methane number of supplied gas during Performance guarantee test. Bidder shall necessarily submit the calculation of reference methane number following complete methodology as mentioned above along with the bid.

3.01.02 Guaranteed performance at above mentioned reference conditions shall be without any output enhancement measure.

3.01.03 The Bidder shall indicate in his Offer all the Performance Guarantees specified in Volume – V, Part A, Section VI as part of “Functional Guarantee Schedule”.

3.01.04 Design cooling water temperature shall be decided by the Bidder based on ambient dry bulb temperature and RH conditions specified above.

3.02.00 Power output

Output of each Engine /Genset

Gross Output (P_G) of **each Engine /Genset** is defined as follows:

P_G = Continuous output of the Genset as measured at the generator terminals. This power output shall be output of the Genset arrived at by subtracting Power taken by excitation system including its transformer losses, as applicable for guarantee points, in case static excitation system is offered.

Plant gross output shall be calculated by adding gross output of each Engine/genset.

Net Output of Genset

Net Output of Genset shall be as defined below -

$P_N = P_G - P_A$ Where,

P_G = Gross Output of a Genset as defined above

$P_A = P_U + P_C/n + T_L$

P_N , P_A , P_U , P_C , T_L and n are as given below-

P_N = Net Output of a Genset. Further, Net Plant Power output shall be calculated by summing the net power output of individual engines.

P_A = Auxiliary Power Consumption per Genset

P_U = All unit specific auxiliaries required to run one Genset.

P_C = Power consumption of all common plant auxiliaries and services including transformer losses (except Generator Transformer), excluding the standby auxiliaries/services, for operation of the complete station.

T_L = Transformer loss of corresponding Generator Transformers.

Note : Transformer losses shall be considered as per following (as applicable)-

1. GT - 100% no load loss, 54% of Copper losses.

2. All Other Transformers - 100% no load loss & 25% of Copper losses.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

n= Number of Genset Modules offered.

For arriving Net Power of each engine, all integral and associated auxiliaries of the Genset shall be in service. Further, following common auxiliaries of the plant shall be in service -

- a. Sea water/bore well water intake pumps (Duty Factor = 0.5)
- b. Desalination plant (Duty Factor = 0.5)
- c. Common cooling water system
- d. Air conditioning, Ventilation & Lighting loads
- e. Compressed air system and Start-up air system (Duty factor - 0.6 for both)
- f. Lube oil purification system
- g. Any other continuously operating equipment/system required for functioning of the Genset.

The power consumption P_u of entire unit auxiliaries shall be measured at respective feeders.

The power consumption P_c shall be measured at the incomers of respective common auxiliary system or the feeders of individual equipment.

In case any equipment of mentioned in common auxiliary system or unit auxiliary is not required to be operated during the test, shop test power consumption at duty point shall be considered.

In case shop test power consumption for equipment/ system mentioned above is not available, then rated power consumption of the equipment/system shall be taken into account while calculating Net Power Output.

The bidder shall furnish a list of equipment to be covered under Auxiliary power consumption, which will be subject to employer's approval.

3.03.00 Net Heat Rate

Net Heat Rate on LHV basis of a Genset shall be computed as follows:

Guaranteed Net Heat rate of each Genset = $[\text{Fuel consumption} \times \text{Net/lower calorific value of Fuel}] \div \text{Net power Generation by the Genset}$.

Where:

Fuel Consumption in SCM/Hour

Net/ lower calorific value of fuel in Kcal/SCM

Power Generation in kW

LHV of the fuel shall be calculated as per relevant codes and standards. Detail procedure for calculating LHV of the fuels shall be finalized at the time of finalizing Performance Guarantee test procedure.

3.04.00 Correction Curves

3.04.01 Performance test of each Engine (output & Heat rate) shall be calculated during PG tests at Site. During evaluation of Performance Guarantee Test results, corrections shall be applicable only for following:

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

- a. Methane Number RLNG fuel
- b. Power Factor
- c. Frequency

Bidder in their bid shall furnish the certified correction curves for above parameters for correcting the Net Output and Net Heat Rate of the each Genset along with their Bid documents.

3.04.02 Only certified correction curves, submitted with the Techno Commercial Offer and accepted by the Employer, shall be used for evaluation of Performance Acceptance Test results. Any subsequent submission of performance correction curves shall not be acceptable.

3.04.03 Bidder shall also furnish all such correction curves that may be required either for establishing demonstration guarantees or for performance assessment of individual equipment for the purpose of performance monitoring during operational stage of the plant. List of such curves shall be finalized during detailed Engineering.

4.00.00 MODE OF OPERATION, START UP, GOVERNING MODE, AND PLANT LIFE

4.01.00 Mode of Operation

4.01.01 Each Genset shall be designed to operate as a Base/Full load and Part load generating unit. Genset shall also be suitable for frequent start and stop mode of operation. However, capability to meet the requirements and withstand stresses of cyclic load variations and partial/ full load rejections shall be built in the plant. Specific design features to permit the above operational flexibility shall be provided. Genset units shall be designed to withstand rapid load changes within the frequency band of 47.5 – 51.5 Hz without any restriction.

4.01.02 The Bidder shall clearly bring out in his offer the various design considerations proposed by him to meet the above requirement and ensure that under such operating conditions as given above, no part/ component of the plant shall be stressed beyond the acceptable safe thermal stress and fatigue levels to get a life of 25 years for the plant.

4.01.03 All equipment, including Engine and Generators/Alternators shall be designed to withstand frequency variation in 47.5 – 51.5 Hz frequency range. Bidder shall indicate the period of operation of Gensets permitted during the life of the plant for operation beyond the frequency range of 47.5 - 51.5 Hz.

4.01.04 Start-up criterion for Genset Module

- (i) Each Genset shall be capable of delivering its full rated output within 5 minutes from Stand-by hot condition (meeting the pre-set Lube oil temperature, Cooling water temperature & Start-Up air pressure as per Engine OEM standard requirements). Start-up command to the Engine Module shall be considered as datum on the time scale.
- (ii) Gensets shall be capable of absorbing the transitory temperature gradients after rapid start and immediate restart. It shall be possible to start and synchronize Genset units at any grid frequency within the frequency band of 47.5 - 51.5 Hz without any restriction.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

4.01.05 All Equipment/ Systems shall be designed to provide flexibility in operation as specified. The Bidder should clearly bring out in detail the 'Plant Operation Philosophy' proposed for the entire plant meeting the above requirements. In order to enable the Employer to verify the above, the 'Plant Operation Philosophy' shall include write-ups for following:

- a. Genset Module Start-up (including preparations) - different start up modes as per standard proven practice of OEM
- b. Base Load and Part Load operation
- c. Load Rejection
- d. Genset Module Shutdown
- e. Prolonged outage (lay-off)

Important operational aspects and limitations (if any) to be considered during each of the above-mentioned operating regimes shall be furnished.

4.02.00 **Plant Life**

4.02.01 The plant shall be designed for a minimum operating life of 25 years for the operating capabilities and duty specified in these specifications. Bidder shall confirm in his offer that all plant components are designed adequately for this lifetime. If there are any items of the plant on which this lifetime cannot be confirmed, the life of such items and the reasons for the same shall be stated in the offer.

4.02.02 **Plant Maintenance during Commissioning/Initial operation Period**

The Contractor shall ensure presence of Genset OEM's experts during all scheduled and unscheduled inspections, without prejudice to the contractor's liabilities in terms of other provisions under the Contract including guarantees and post-commissioning services. Contractor shall be responsible for all scheduled and un-scheduled inspections and maintenance activities of the complete plant. The Contractor shall be responsible for all expenses towards services and materials required for all such Inspections and repairs/replacements.

Owner/Client shall only be responsible for the availability of Fuels within the plant premises during above period.

4.02.03 **Responsibilities during Supervision period (1 year)**

The supervision of O&M period shall commence after takeover of the plant post successful completion of initial/trial operations & Performance guarantee tests including Demonstration tests (whichever occurs later).

The contractor shall ensure the complete presence of OEM expert (1 operation and 1 maintenance) during this period who will be responsible for day-to-day operations and routine maintenance activities. Contractor shall be responsible for guidance during all scheduled and un-scheduled inspections and maintenance activities of the complete plant.

The experts shall be responsible for bringing the unit from startup to full load (including complete plant startup related activities) safely. He shall be responsible for training the employer's executive for operating the power plant under all circumstances (full-load, Part-load and technical minimum). He shall be able to train employer's executive for all

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

types of startups, shutdown and all emergency condition that may arise during normal operation of plant. Also, during any emergency or unit tripping, the responsibility of shutting down the unit safely lies with the contractor.

4.03.00 Capabilities for variations in Ambient/ Operating and Fuel Properties

4.03.01 The Plant shall be designed for trouble free and reliable operation within the following range of operating and ambient conditions:

	Design Reference	Range of Variation
Ambient Temp. (DBT)	28 °C	14.6 to 36.1 °C
Barometric Pressure	1001.8 mbar	996.9 to 1014 mbar
Relative Humidity (RH)	80 %	65 % to 100 %
Grid Frequency	50 Hz	47.5 to 51.5 Hz

Other variations indicated in Project Information and specified in Technical Specifications (Part B) shall be duly considered in the overall design of the plant.

4.03.02 Design and sizing of Engines, Electric Generators/Alternators, Cooling Systems, various mechanical and electrical auxiliaries and other balance of plant (BOP) equipment shall be not be constraint, whatsoever, for achieving the 100% base/full load output at all conditions within the specified range of operating conditions.

4.03.03 RLNG composition range indicated in Project Information (Annexure-IA, Volume – II, Part A) is the fuel. Engine and support systems shall be designed and sized to accept RLNG of any composition within the specified range. Equipment/ systems required to provide the above flexibility is included in Bidder's scope of supply.

4.04.00 Reliability, Availability and Maintainability

4.04.01 Design, Redundancy, Plant layout and Maintenance Practices in respect of all the components of the plant shall be such as to achieve good Reliability, Availability and Maintainability throughout the Plant Life.

4.04.02 Redundancy level in plant equipment and systems shall be such as to support operation of the plant in all specified modes of operation. Where redundant (standby) equipment is provided, the standby equipment shall be capable of automatic and immediate initiation in to operation upon failure of one or more of the running equipment. Necessary instrumentation and controls to sense the failure of running equipment and initiation of standby equipment shall be provided.

4.04.03 The Bidder shall necessarily include in his offer the Inspection/ Maintenance Guidelines for Engines, Generators/Alternators, pumps, motors and other associated equipment installed in the plant to ensure min. 90% plant availability.

4.05.00 Design requirements for conductance of Periodic Performance Tests

In addition to the initial Acceptance Tests to be conducted by the Contractor, the Employer would be conducting periodic Performance Tests for Gensets and their associated individual equipment/ systems. The Bidder shall duly consider the requirements for instrumentation accuracy (as per applicable test codes), recalibration requirements of on-line Instruments, location of plant instrumentation (to be used for testing) and provision for installation of temporary test instrumentation and design the systems and equipment accordingly.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

5.00.00 CYCLE REQUIREMENT AND DESIGN CRITERION OF POWER PLANT EQUIPMENT

5.01.00 General

- 5.01.01 The offered plant shall be complete in all respects for safe and reliable operation for the operating regimes and duty conditions specified. Considering the conditions particular to the site e.g. coastal location, high humidity round the year and heavy rainfall, necessary design attention shall be given to protect the installation against corrosion and mitigate the effect.
- 5.01.02 All Gensets shall be identical to each other in respect of performance, sizing, equipment design and interchangeability of equipment and subassembly or component of an equipment.
- 5.01.03 Each Genset shall be independent in all respects i.e. part or full outage of a particular Genset shall not hamper trouble free sustained operation of the remaining Gensets in any way, whatsoever.
- 5.01.04 The design criterion specified here in the following paragraphs pertains to the project specific requirements in respect of sizing and configuration. Equipment specification shall be as per respective chapters of Part – B, Section – VI.

5.02.00 Genset & Support Systems

- 5.02.01 Gensets shall be capable of trouble free and sustained continuous operation at all ambient and operating conditions specified.
- 5.02.02 The plant site is in the close vicinity of sea, accordingly Air Intake Filtration System of Engines and all other equipment shall be designed to ensure that maximum level of NaCl and the treated air does not exceed the maximum allowable value. Airborne salt concentration shall be considered as typical for a tropical coastal location for the climatological conditions specific to the plant site.
- Further, the complete system of the power plant shall be designed to withstand local climate conditions (plant located close vicinity of sea) and other climatic conditions specific to the site.
- 5.02.03 The design philosophy of all the Genset auxiliaries shall be as per the standard proven practices of the Original Equipment Manufacturer (OEM) of Genset & all drawings/ documents shall be vetted by the Genset OEM during execution stage

6.00.00 ENVIRONMENTAL REQUIREMENTS

6.01.00 Noise Levels

The noise levels shall meet the guidelines as enclosed at Annexure-IA of Volume-IV, Part-A, Section-VI.

6.02.00 NOx Emission Limits

- 6.02.01 The Guaranteed NOx level (on dry volume basis corresponding to 15% excess oxygen in flue gas) for each Engine shall be as follows:
- RLNG - less than 80 ppm

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

Above specified guaranteed NO_x emission level for each Engine shall be demonstrated at different loads varying between 50% and 100% of the design output rating of the Engine at specified site reference conditions.

Emission shall meet the standards notified for NO_x from Gas/ Naphtha Based TPP published vide notification dated 22.12.1998 by MoEF under E (P) Rules.

- 6.02.02 NO_x guarantee shall be for the Total NO_x which is defined as summation of NO_x formed by Oxidation of atmospheric nitrogen in the combustion air (thermal NO_x + prompt NO_x) and NO_x formed from the nitrogen chemically bound in the fuel (FBN). If the fuel specification given in Project Information Chapter does not indicate FBN, typical representative value shall be suitably considered by the Bidder and shall be indicated in the Offer.
- 6.02.03 NO_x Control equipment shall be designed to achieve the above specified NO_x level in all ambient conditions specified.
- 6.02.04 Online NO_x, SO₂, and CO monitoring of exhaust gas at each stack outlet shall be provided.

6.03.00 Liquid Effluents

- 6.03.01 All liquid effluents emanating out of the power plant shall be treated (as required) to meet the Environmental Standards for Gas Naphtha-based Thermal Power Plants published by MOEF vide notification dated 22.12.1998 and General Standard for Discharge of Environment Pollutants, Part-A: Effluents Published by MOEF dated 19.05.93 & also the latest MoEF&CC notification for discharge standards for effluents dated 13.10.2017 under E(P) Rules & its amendment thereof, applicable for discharge in Inland Surface Waters, whichever are more stringent.
- The discharge standards to be followed are enclosed at Annexure-II (A) & Annexure-II (B). The treated effluents shall also meet quality requirements of CPCB, if more stringent than the standard mentioned in technical specifications.
- 6.03.02 Devices for measurement of pH, Turbidity, Conductivity, and Flow at the point of liquid effluent discharge out of the plant shall be installed.

7.00.00 FUEL HANDLING SYSTEM

7.01.00 Gaseous Fuel Handling System

- 7.01.01 RLNG is envisaged as fuel for the project. Properties of the gaseous fuel envisaged for the project is indicated in Project Information, Part-A, Volume-II, Section-VI of Technical Specification. Employer shall arrange the gas within the premises of power plant. Bidder shall connect the gas supply line with incoming line terminated inside the plant boundary. Further, Bidder shall ensure the gas parameters and quality as per the requirement of his engines. Any modifications/equipment/systems required to meet the gas parameters and quality shall be under bidder's scope.

8.00.00 DESIGN CRITERION FOR PIPING SYSTEMS

- 8.01.00 Design, fabrication, assembly and testing of pipes, fittings, flanges, piping components, valves and specialties, thermal insulation, etc. shall generally conform to the requirements of ASME B 31.1 and other relevant ASME standards.
- 8.02.00 Design basis for 'Piping' shall be as per Part B of Technical Specification.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

8.03.00 All over ground pipes (Cooling Water, gaseous fuel, fire-fighting etc.) shall be provided with suitable protection against the corrosive coastal atmosphere.

9.00.00 Fire Detection and Protection System

9.01.00 General Design Criteria

- i) The fire protection system shall consist of fire water storage tanks, fire water pumping system, fire water hydrant and spray system serving the whole station including plant/ facilities/ buildings.
- ii) All major equipment/ system components in the entire fire protection & detection system shall have the approval from one of the following:
 - a) Underwriters Laboratories of USA
 - b) LPCB –UK
 - c) VDS
 - d) BIS
 - e) FM - USA
- iii) Any other additional equipment not specifically mentioned in the technical specification but are found necessary to meet the requirements of TAC norms and also for safe and sound operation of the plant are to be included at no extra cost to Employer.
- iv) During normal operation period, whenever required, electric motor driven fire water pumps shall run on A.C. power supply. However, in case of complete black-out condition, DG set being provided is required to cater the load of electric motor driven fire water pumps so that fire protection system remains available during complete black-out conditions. The equipment to run on DG set are:
 - (a) One (1) no. main fire water pump
 - (b) Two (2) nos. jockey pumps
 - (c) Two (2) nos. fire water transfer pumps

9.02.00 Hydrant System

Design philosophy (minimum requirement)

- i) Category of Hazard and minimum terminal pressure shall be as per TAC norms.
 - ii) Fire water ring mains shall be provided as per TAC norms with isolation valves (gate valves) between various ring mains.
 - iii) At locations where water cannot reach through ground level hydrants, water monitors at required intervals shall be provided. In addition to above fire hydrant to be provided at 45 Mtr. Risers for these hydrant valves shall be supported Further, fixed water monitors shall also be provided where elevation having elevation 15M or more.
 - iv) All the landings various building and other multi storied structures of the plant shall be provided with hydrant landing valves. Further, Gate Valve shall be provided as isolation valve in each riser of internal hydrant system.
 - v) Each of the landing valves and external hydrant valves associated with the main plant, switchyard & transformer areas and other areas/building shall be provided with a hose box. Each hose box shall contain two (2) numbers of 15M long hoses & coupling, branch pipes & nozzles, spanner etc. as per TAC guidelines.
- 1.01.01 For landing valves of various buildings, the hose box shall have two (2) numbers 7.5 m long hoses, branch pipes, couplings, nozzles, spanners, etc. as per TAC guidelines.

9.03.00 HVW & MVW Spray System

Design Philosophy (Minimum Requirements)

- i) Design discharge density shall be as per the rules of TAC and/ or NFPA standards.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

- ii) Deluge valve along with trims like pressure gauge, water motor gong, etc. shall be UL/FM or equivalent approved / listed. The deluge valve (auto resetting type) assembly shall consist of accessories such as water motor gong, alarm test valves, drip/drain valves, strainers for these valves, hydraulic releasing system, solenoid valves, etc. Further, the design features and make of all the projectors / spray nozzles shall be UL/FM or equivalent approved / listed.
- iii) A strainer ("Y" type) be provided at upstream of deluge valve. Each deluge valve shall be provided with isolation gate valves (with limit switch) upstream & downstream.
- iv) Pressure switches be provided in spray and detector piping to exhibit "FIRE" and "SPRAY ON" annunciations and as well as for interlock.
- v) Wet type pipe detector network shall be provided for spray system using quartzoid bulb detectors.
- vi) Each outdoor deluge valve housing shall be provided with brick wall housing on three sides and RCC roof. The fourth side of the enclosure shall be in a direction away from protected equipment. Indoor deluge valve(s) which are within 6 meters of the protected equipment shall also be separated from the latter by a brick wall enclosure.
- vii) Remote manual operation of the deluge valves shall be possible from the respective fire alarm cum control panel through the keyboard operation of PC monitoring station when the system is selected in remote manual mode. The remote manual selection for the operation of spray system on any equipment or any zone shall also be through the monitoring station of the respective panel. Apart from the automatic operation of the deluge valve, the system shall have provision for manual operation of the deluge valve by means of hand operated lever close to the deluge valve assembly. There shall also be a provision to operate deluge valve electrically from a nearby local panel.

9.04.00

Fire Detection, Alarm and Control System

Design Philosophy (Fire Alarm and Detection System)

- i. The PLC based panel at fire water pump house shall indicate the status of each pump, system pressure, operation of hydrant and/ or spray system, failure of starting of pumps, healthiness & failure of batteries/ chargers, main supply, low level of fuel oil of diesel engines, tripping of pumps, low level / very low level of water in the water supply system, status of batteries & chargers of panels and diesel engines etc. Alarms from these panels shall also be available to operator at fire alarm addressable panels, central monitoring station and DDCMIS.
- ii. The addressable type panel at Control equipment rooms shall receive signal from sensors from various areas/ equipment of the respective units.
- iii. The central monitoring station to be located at main control room shall cover the fire detection and protection system of the complete (all the areas) plant. This shall give audio-visual annunciations for fire in each of the risk area / equipment / status of the fire protection system as well as system operator open / short circuit status of detector or control cabling, etc. Further, this shall activate a hooter/sounder in each of the area provided with fire/smoke detection system.
- iv. Alarms from all the panels shall be repeated simultaneously in repeater panel at Fire station.
- v. The addressable panel shall evaluate the signals received from the detectors, transmit the fire or trouble alarms (audio-visual) to prearranged points, supervise and monitor the complete fire detection & extinguishing circuits, initiate control functions like shutdown of draft fans, air-conditioning and ventilation plant/equipment, closure of Fire dampers in A/C & Ventilation system etc. Opening smoke extraction vents, switching on smoke extraction equipment emergency lighting, tripping of transformer lockout relays etc.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

- vi. All the circuits from the detectors to the panels and the circuits from the panels to the actuating devices (such as solenoid valves, deluge valves, push buttons etc.) shall be closed loop type and shall be supervised for open and short circuiting. The trouble signal also be annunciated in the respective panels.
- vii. Facilities shall be provided on the fire alarm panel for simulating fire conditions, sensitivity adjustment, isolation of detectors etc. from the panel.

9.05.00 Total Flooding Inert Gas Extinguishing System

9.05.01 Design Philosophy (Minimum Requirements)

General

- a) Complete design and all critical components / equipment like cylinder, cylinder valve assembly, hoses, check valve, actuation controls, restrictor/pressure reducer, directional/selector valve, pressure relief device/safety valve, pressure gauge, pressure switch, nozzle, etc. shall be approved and listed by UL/FM /VDS /LPCB or equivalent.

Basic design parameters of inert gas extinguishing system like type of inert gas agent, extinguishing/design concentration, safety factor, discharge time, etc. shall be considered in strict accordance with NFPA-2001 (latest edition). Piping design/layout, nozzle arrangement/orientation, etc. shall conform to UL/FM/VDS/LPCB or equivalent.

Agent Supply, Design Concentration, Quantity & Discharge time

- a) System shall be designed to meet the minimum requirements of total flooding inert gas extinguishing system as per NFPA 2001. However higher concentration may be used if it is specified by the agent manufacturer/ system supplier for the area protected.
- b) The complete volume of the rooms including the above false ceiling shall be considered for estimation of quantity of gas and containers.
- c) When determining the gas quantity, the leakage losses from the enclosure shall be taken into account by the supplier. Further volume of re-circulating type air conditioning system & its duct work (at least up to the automatic fire dampers of the ducts) shall be considered as a part of the total volume so that the design concentration is achieved throughout the hazard area. Further gas quantity shall be adjusted for ambient pressure & temperature conditions. Bidder to provide primary supply of gas & its cylinders, along with 100% (one hundred percent) standby / reserve gas quantity and cylinders for each room/area.
- d) However, if the system design permits provision of a common "ENGINEERED STORAGE SYSTEM" with directional valves for multiple rooms / areas of one unit, such a design is acceptable provided the total primary supply and/or reserve supply is equivalent to the requirement of largest area / room and such rooms /areas are perfectly separated from each other by means of wall / metal cladding or floor of minimum required fire rating. Such common storage system should have been listed & approved by UL/FM/VDS/LPCB or equivalent and bidder should produce documentary evidences for design and installation of such systems elsewhere in the past by them.
- e) In either of the case mentioned in above two clauses, both the main & reserve supply cylinders shall be permanently connected to the distribution piping through manifold and arranged for easy changeover from the panel. Suitable selector switches be provided for "Normal /Standby "supply selection.
- f) The discharge time period shall be such that the design concentration is achieved within time duration specified in NFPA-2001 (latest edition/amendment) The flow calculations shall establish this criterion.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

- g) The quality of gas shall conform to relevant design standard such as NFPA – 2001(latest edition) or as specified by listing authorities.
- h) Clean agent discharge test shall be done for smallest inert gas protected zone.

Storage containers

- a) The storage cylinders offered shall be of seamless type & brand new. Welded cylinders are not permitted.
- b) All the storage containers shall be provided under an enclosure. It shall not be kept open to atmosphere.
- c) The storage containers shall be securely installed as per the listed installation manual with a provision for convenient individual servicing and container weighing. Such servicing or weighing shall be possible without shutting down the system.
- d) Automatic means such as check valves shall be provided to prevent gas loss if the system is operated when any containers are removed for maintenance.
- e) The storage containers shall not be charged to a fill density or super pressurization level different from the manufacturer's listing.
- f) The design pressure for storage cylinders shall be suitable for the maximum pressure developed at 55 degC and shall be designed to meet the requirements in NFPA-2001.
- g) All cylinders shall bear the marking as detailed out in NFPA -2001 and shall be duly listed by UL / FM /VDS/LPCB or equivalent in addition to approval by Chief Controller of Explosives - INDIA.
- h) The storage cylinders shall have accessories such as pressure gauges/ switches, liquid level indicators (if applicable), refilling connections, relief devices (if applicable) etc. A reliable means of indication other than weighing shall be provided to determine the pressure in cylinders.
- i) All the pressure gauges/switches, manifold connections etc. shall be easily removable for servicing / maintenance without any loss of gas.

DISTRIBUTION

- a) Both main & reserve cylinders shall be permanently connected to the distribution piping through manifold and arranged for easy & auto changeover. Cylinder Manifold, directional valve manifolds, Piping, fittings & pressure relieving device shall be designed for the maximum design pressure of the system and shall conform to the requirements of NFPA -2001 (latest edition) or as specified by listing authorities. Material of construction for manifolds shall be as per listed design manual and shall be hydro-tested as per design manual or at 1.5 times the maximum design pressure, whichever is higher.
- b) Discharge nozzles along with deflector shields shall be listed for the intended use including the flow characteristics and area of coverage and quantity & design shall be such that complete quantity of gas is uniformly distributed throughout the hazard volume within the specified discharge time without disturbing the ceilings, lighting fixtures etc.
- c) The fire detection system to be employed shall be as specified elsewhere. Operating devices shall be by mechanical, electrical and pneumatic means conforming to NFPA-2001. The power supply to electrical actuators shall be backed up with reliable battery supply. Such batteries shall be charged automatically by battery chargers. Power supply be taken from the Fire detection /alarm system panels of the respective units. Required annunciations such as "Gas released", "Failure of automatic actuation" etc. shall be exhibited in the fire alarm panel.
- d) Where pilot cylinders are employed for actuation of the cylinder banks, the number of pilot cylinders shall be as per the listed design manual.
- e) Facility for manual release of gas through push buttons be provided along with selection facility of "Auto/Manual" from the panel.

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- f) In addition to this, local manual release through lever operation shall also be provided near the cylinder banks.
- g) All manual-operating devices shall be identified to the hazard they protect by fluorescent paint.
- h) Manual abort switches shall be provided for each of the area/zone and the same shall be provided as per NFPA -2001 or as specified by listing authorities.
- i) The gas releasing devices at cylinder outlets shall be of re-usable type after discharge at any instant.
- j) Supervision of automatic actuation devices, power supply, manual actuation circuits, and complete wiring shall be provided through control system /panel and the healthiness shall be reported or indicated in the panel automatically. Complete control system shall be listed and approved by UL/FM/ VDS/LPCB or equivalent.

Design, Installation & Testing

- a) System design, specifications, working plans, flow calculations etc shall be prepared in line with the NFPA-2001 or as specified by listing authorities and shall be approved by Employer. The system flow calculations shall be performed using a calculation listed or approved by UL/FM /VDS/LPCB or equivalent.
- b) Calculation shall be provided by the designer to prove that the area is not pressurized and extinguishing capability is not affected due to provided ventilation of that area. Bidder to provide additional ventilation arrangement if required.
- c) After installation, the complete system shall be inspected and tested as per the recommendations of Chapter-4 & relevant Clauses of Appendix-A of NFPA-2001. Wherever testing is mentioned at a regular frequency in these chapters, the bidder shall carry out initial testing and records shall be presented to Employer for approval of the installation.
- d) Prior to handing over of the system to Employer, the supplier shall provide operational training to Employer's operating personnel which shall consist of control system operation, trouble procedures, emergency procedures, safety requirements etc.
- e) The complete installation, testing, commissioning & training shall be carried out by the Contractor under the supervision of the Manufacturer/ designer at site.
- f) The performance test of the system shall be carried out by releasing the agent gas in a selected area and design parameters shall be measured. All equipment, refilling of gas after test, instruments etc. shall be provided by the contractor for the same.

SAFETY

- (a) All the safety requirements recommended in NFPA -2001 or as specified by listing authorities shall be incorporated in the installation by the bidder.
- (b) Appropriate warning signs shall be fixed outside of those areas protected by the system and also in areas where the gas may spread indicating clearly the hazard associated with the system such as Noise, turbulence, cold temperature, physiological effects on personnel etc.
- (c) Apart from written warning signs, audio-visual type warning signs (i.e) hooters & strobe lights shall be provided for pre-discharge and post-discharge activity. The sounder shall have selectable tone options.
- (d) The gas shall be discharged after a set time delay on receiving signal from the fire detection system. The duration of the timer shall be upto a range of 0- 5 minutes (adjustable in 1 minute variation) at site after conducting test to find out the duration for evacuation of the personnel from the area.

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- (e) To prevent the loss/release of gas automatically or manually during maintenance, the system shall have the facility of "LOCKOUT". The status of the system lockout condition shall be annunciated audio-visually in the panel.

Pressure Venting

Since huge quantity of gas is envisaged to be released, proper pressure relief and ventilation systems such as fans, dampers, etc. shall be provided by the contractor. Required openings in the civil structure shall be provided. The contractor shall submit pressure relief, venting calculations, its requirement and suggestive mode of ventilation during detailed engineering for approval.

10.00.00

AIR CONDITIONING AND VENTILATION SYSTEM

10.01.00

DESIGN PHILOSOPHY - Air conditioning system

1. Design ambient conditions for all air conditioning system shall be as indicated below:

Season	Dry Bulb Temp. (Deg. C)	Wet Bulb Temp. (Deg. C)
Dry	38	33.8
Rainy	32	30.6

2. All equipment of Air Conditioning system shall be designed for continuous duty.
3. All air-conditioned areas like control room, control equipment rooms, office room, meeting/conference room, shift in-charge room, etc. shall be maintained at 24 deg. C \pm (plus or minus) 1 deg. C and relative humidity of 50% \pm (plus or minus) 5%.
4. The fresh air quantity for air-conditioned areas of Control Room / Control Equipment Room / UPS, etc. shall be 0.45 M³/minutes/person or 1.0 air change per hour whichever is greater. However, for other areas quantity of fresh air shall be minimum 1.5 air changes per hour.
5. Lighting load shall be minimum 1 Watts/Sq.feet or actual whichever is higher.
6. The occupancy for general area shall be minimum one person per 10 Sq. M and for conference room the same shall be one per 3 Sq.M. In the control rooms, control, equipment rooms etc., the occupancy may be one person per 25 Sq.M (Minimum).
7. In Air conditioning system the return air shall be through ducts and use of plenum space for return air shall be avoided.
8. The supply and return air ducts shall be provided with automatic (motorized) fire dampers (of 90 minutes fire rating) at locations where ducts pass through walls (with perfect partition i.e. partition both above & below false ceiling) & floors. Operation of these dampers shall be interlocked with the fire alarm system and shall also be possible to operate manually from the remote-control panel. Required electrical contacts shall be provided in control panel of A/C by the Contractor for further wiring upto fire alarm panels.
9. Air distribution system shall be sized to have a constant frictional drop along its length and velocity through ducts shall not exceed 7.6 m/sec.
10. For Packaged Air conditioners serving main plant control area, where microprocessor based equipment are located, the dehumidified air shall be filtered at two different stages i.e. pre (coarse) filter followed by fine filter before discharge it to conditioned space.
13. A minimum design margin of ten (10) % shall be considered in design of AC Plant Capacity for each area. For areas, where A/C load is of the order of

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25-60 TR, Direct Expansion (D-X) type air-cooled condensing units alongwith AHUs shall be provided depending on the availability of space/ layout etc. For areas, where A/C load is of the order of 5-25TR, ductable split/package A/C shall be provided. Smaller areas, which are away from the D-X type-condensing unit /central chilling units, which may require air conditioning up to 5 TR rating, shall be served with non- ductable split (Hi-wall/Cassette) air conditioner units as per requirement.

- 13.1 Refrigerant: Refrigerant should be CFC/HCFC free.
- 13.2 Insulation for supply and return air ducts: Supply and return ducts shall be insulated.
- 13.3 All types of Insulation used for HVAC application shall be CFC/HCFC free.
14. During normal operation period, all the working equipment shall run on A.C. power supply. However, in case of complete black-out condition, DG sets being provided are required to cater the load of some of the air-conditioning equipment so that Main Plant Control Rooms and CER remain air-conditioned. The equipment to run on DG set are:
 - 1 No. Packaged air conditioner.
 - 1 No. Fresh air fan.

10.02.00

DESIGN PHILOSOPHY OF VENTILATION SYSTEM

1. Air changes per hour in mechanically ventilated areas shall be as follows:
 - i) Main machine hall - 30
 - ii) General areas - 20
 - iii) MCC / Switchgear rooms and Battery - 30Rooms & other areas where gaseous fumes/ vapours are generated
2. However in areas producing lot of heat, temperature shall be the criteria as follows:-
 - a) Inside Temperature shall be maximum 6deg.C above the design ambient temperature during summer for mechanically ventilated Engine Hall.
 - b) Inside Temperature shall be maximum 3deg.C above the design ambient temperature during summer for mechanically ventilated other areas.

Note: Dry bulb temperature during summer season mentioned at Sl. No. 1 of 10.01.00 (Design philosophy-Air Conditioning System) shall be considered as Design Ambient Temperature for above.

The criteria which give higher number of air changes/higher quantity of air of either of condition (Cl. 1 or 2) flow shall be selected.

3. All ventilation systems shall operate on 100% fresh air. All mechanically ventilated areas shall be positively ventilated by means of supply air fans fitted with filters and/or gravity operated back draft dampers and exhaust fans. MCC / switchgear and cable gallery areas shall be provided with gravity operated back draft dampers in association with supply air fans in order to maintain positive pressure. Battery rooms and other fumes/odor generating areas shall be negatively ventilated by means of exhaust air fans / roof exhausters. Supply air fan catering for electrical areas (MCC & Switchgear rooms) shall be provided with pre-filters and fine filters and for other areas shall be provided with pre-filter only.

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4. All the equipment of Ventilation system shall be designed for continuous duty.
5. Supply air fans, exhaust air fans & ventilations of each area shall be provided with local starter panels.

11.00.00 COMPRESSED AIR SYSTEM

DESIGN CRITERIA / BASIS AND PERFORMANCE GUARANTEE

1. All the equipment shall be designed for continuous duty and as well as for intermittent operation. Frequent start/stop of the system shall not result deterioration in performance nor damage to the equipment.
2. The compressors and Air Drying plants shall operate under the following ambient conditions.
 - i. Minimum temperature : 15 deg. C
 - ii. Maximum temperature : 40 deg. C
 - iii. Design condition (temperature & Relative humidity) : 40 deg. C & 85% RH
 - iv. Height above MSL (m) : Refer Chapter "Project Information"
3. The design ambient conditions for the motors shall be as mentioned in relevant Electrical sub-sections.

11.01.00 Selection of Capacity of Air Compressor

11.01.01 Air Compressor for Instrument & Service Air Application:

- i) Air Compressor shall be designed to meet the Instrument air and service air requirement of all the equipment/plant/systems to be supplied by the Contractor for Andaman & Nicobar Gas Power Project as follows:

Sl. No.	Continuous Requirement	Quantity (in NM ³ /min)
1.	For all Gensets & it's auxiliaries	A
2.	For Water Treatment Plant	B
3.	For C&I System	C
4.	Service air requirement for entire plant	D [with D= 2.5 Nm ³ /min (minimum) or as per system requirement]
5.	Total air requirement	= A+B+C+D
6.	Capacity of Air compressor	= 1.3 X (A+B+C+D)

Notes:

1. While calculating the air requirement of Bidder's equipments/plant/systems, for continuous requirements of instrument air & service air, no diversity factor shall be considered and they are to be assumed to be of "Simultaneous Requirements". The intermittent requirement of instrument air & service air, if any, shall be converted into continuous requirement by considering frequency of such requirements or selecting an appropriate diversity factor and such diversity factor shall not be less than 0.4.
2. The capacity of air drying plant shall be equal to the capacity of the individual air compressors. The Air drying plant, at its rated capacity, shall be designed to deliver continuously air at dew point of minus (-) 40 deg C at atmospheric

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pressure and the Quality of dry outlet air to conform to Instrument Society of American Standard S7.3 "Quality Standard for Instrument Air".

3. Discharge pressure available at the outlet of Air drying Plant shall be minimum 7.0 Kg/cm² (g) or more as per the requirement of Contractor.
4. The discharge pressure of compressor shall be minimum 8 Kg/cm²(g).
5. The heat exchangers are air cooled.
6. Noise level shall not exceed 85 dBA to a reference level of 0.0002 microbar when measured at a distance of 1.5 meter above the floor and 1m horizontal distance. Required acoustic enclosures may be provided to meet the above condition. The discharge blow-off silencer and intake silencers shall be designed to meet the above noise limitation level. For eventual noise, from the discharge line, accessories and/or ancillary equipment which are not included, a correction factor of (+)8 dBA maximum shall be allowed for background & ambient noise.

Similarly, vibration level of screw compressor shall be as per VDI-3836. However, velocity vibration shall be limited to 10mm/sec (rms). Vibration level of centrifugal compressor shall be as per manufacturer standard & proven practice.
7. Parallel operation of compressors shall be possible without any undue vibration and noise.
8. The flow in compressed air piping shall be designed for the design capacity of each compressor and the flow in header and ring mains to be designed for the total capacity of working compressors.
9. The Air compressors & Drives, instruments, control panels and ADPs shall preferably be located indoor inside the machine hall and the air receivers shall be located inside the machine hall. The EOT crane in machine hall shall be used for the operation or maintenance of air compressors. In case the air compressors are not in approach of the EOT crane, separate monorail beam (along with supports) with electric hoist shall be provided for handling air compressors. Further, if Air Compressors, Air Drying Plants, Air Receivers, etc. are not possible to be placed within machine hall, then separate compressor house (monorail beam along with support & electric hoist by Contractor) shall be provided by Employer.
10. All hot vessels/pipelines/ valves shall be insulated to restrict the outside temperature within 60 deg. C or less with mineral wool (or equivalent), GI wire netting and aluminum cladding/cover.

12.00.00 CONTROL & INSTRUMENTATION

Detailed requirements on C&I design philosophy to be followed for the project, same shall be as per Part-B, Section-VI of the Technical Specifications.

13.00.00 ELECTRICAL

Detailed requirements on electrical design philosophy to be followed for the project, same shall be as per Part-B, Section-VI of the Technical Specifications.

14.00.00 DESIGN CRITERIA FOR BALANCE OF PLANT (BOP) SYSTEMS

Detailed requirements on BOP systems design philosophy to be followed for the project, same shall be as per Part-B, Section-VI of the Technical Specifications.

15.00.00 PROVENNESS OF EQUIPMENTS/SYSTEMS

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The bidder/its sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for the items/ services listed below as per the stipulated criteria indicated in the respective clauses..

15.01.00 The offered Gas engine should have logged a minimum of 4000 fired hours since commissioning and should have been in successful operation for a period of at least one (01) year prior to the date of techno-commercial bid opening. The Bidder shall furnish experience list of Gas engine offered to substantiate their provenness along with the techno commercial bid.

15.02.00 Main plant auxiliaries and balance of plant equipment/ systems:
The bidder/ his sub-vendor(s) is required to meet the provenness criteria for equipment(s) / system(s) and bought out items as per the criteria stipulated below.

15.02.01 The following equipments offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration/Licensing agreement), manufactured/got manufactured the respective equipment(s) of the type and the minimum equipment rating as stipulated below such that the respective equipment should have been in successful operation for a period of at least one (1) year on or before six(6) months after award date of Andaman & Nicobar Gas Power Project package.

S. No.	Name of Equipment/system	Type/Detail of Equipment/system	Equipment Rating
Gas Engine Auxiliaries and Support Systems			
1.	Starting air system	Starting air compressor and air receivers	As required for the offered RLNG fired fuel Engine.
2.	Engine lub oil system	Engine main lube oil pump, pre-lub oil pump & lub oil filter	As required for the offered RLNG fired fuel Engine.
3.	Engine Cooling System	Engine cooling pumps & radiator cooling package	As required for the offered RLNG fired fuel Engine.
4.	Exhaust gas system	Gas silencer, Expansion bellows & rupture disc on exhaust ducting	As required for the offered RLNG fired fuel Engine.

15.03.00 **Fire Detection and Protection System:**
The bidder/its sub-vendor should have designed, supplied, erected and commissioned at least one (1) Fire protection System of contract value not less than INR 35.0 million or equivalent in foreign currency (exchange rate applicable as on date of Techno-commercial bid opening), in industrial installation. The fire protection system should have comprised of:

- a) Fire hydrant system.
- b) High velocity water (HVW) spray or medium velocity water (MVW) spray or sprinkler system.
- c) Fire water pumping and pressurizing arrangement.

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The system mentioned above should have been designed to the recommendations of Tariff Advisory Committee of India or Oil Industry Safety Directorate (OISD) or any other International reputed authority (like LPC-U.K. or NFPA, USA) and this system should have been in successful operation for a period of not less than one (1) year on or before six(6) months after award date of Andaman & Nicobar Gas Power Project package.

In addition, the analogue addressable type fire alarm system proposed to be supplied shall be sourced from a firm who has supplied at least one (1) similar system which has been approved or listed by UL-USA/ FM-USA / LPC-UK/ similar agency and should have been in operation for at least one (1) year on or before six(6) months after award date of Andaman & Nicobar Gas Power Project package. Further, the inert gas fire extinguishing system shall be sourced from agency who has designed and supplied at least one (1) inert gas total flooding fire extinguishing system each having a total risk volume of at least 500 cum. This system must have been designed to the recommendation of Tariff advisory committee of India or any other international reputed authority (like LPC-UK or NFPA, USA) and should have been in operating condition for a period not less than one (1) year on or before six (6) months after award date of Andaman & Nicobar Gas Power Project package.

15.04.00 **Compressed Air System:**

The bidder/its sub-vendor should have designed, manufactured, supplied, erected/supervised erection and commissioned/supervised commissioning at least one (1) number non-lubricated oil free screw type air compressor of minimum capacity 10 NM³/min at rated discharge pressure of 8 kg/cm² (g) which should have been in successful operation for at least one (1) year on or before six(6) months after award date of Andaman & Nicobar Gas Power Project package.

The Air-Drying Plant (A.D.P) shall be supplied from such manufacturers who have manufactured and supplied at least one (1) number Air Drying Plant of capacity 10 Nm³/min or more and the type same as offered, which should have been in successful operation.

15.05.00 **ELECTRICAL EQUIPMENTS:**

15.05.01 Generator:

The offered synchronous generator (alternator) shall be from such a manufacturer who has manufactured and supplied synchronous generator of offered MW rating or above rating, which should have been in successful operation in at least one (1) plant for a period not less than one (1) year on or before six(6) months after award date of Andaman & Nicobar Gas Power Project package.

15.06.00 **SOLAR PV ROOFTOP ON PLANT BUILDINGS:**

15.06.01 Solar PV rooftop EPC contractor:

The Bidder or its Sub-vendor should have designed, supplied, erected/supervised erection and commissioned/supervised commissioning of SPV based grid connected power plant of at least one plant of 40 kWp or above. The reference plant of 40 kWp or above capacity must have been in successful operation for at least six months

15.06.02 Solar PV Module:

The bidder/sub-contractor shall meet the requirements as stipulated in para (a) and (b) below for supply of solar PV modules:

a) The Bidder / sub-contractor should have manufactured and supplied the solar PV modules of cumulative installed capacity of 1MWp or above using any rating of modules and any source of indigenous or imported PV cells in any one financial year.

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b) The Bidder / sub-contractor should have manufactured and supplied solar PV modules built up using indigenous and/or imported PV cells of power rating 300Wp or above which must have been in successful operation for at least six months

Note: The works referred at clause 15.06.02 (a) & 15.06.02 (b) can be in same or different projects.

- 15.07.00 Balance equipment's/ systems:
The Bidder at its option can source the balance of plant equipment/systems not covered in clause 15.01.00, 15.02.00, 15.03.00, 15.04.00, 15.05.00 & 15.06.00 above. However, for such balance of plant equipment/systems, the Owner reserves the rights to satisfy himself on the provenness of the equipment and capability and capacity of the manufacturers
- 15.08.00 Notwithstanding anything stated above, the Employer reserves the right to assess the capabilities and capacity of the Bidder/its Collaborators/ licensor/ its sub-contractors to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer.
- 15.09.00 To enable the approval of sub-vendors, the Bidder shall provide all necessary data such as type, design, make, capacity, duty conditions, date of commissioning/ operation etc.

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

[annexure – i \(A\)](#)

MINISTRY OF ENVIRONMENT AND FORESTS

New Delhi, the 22nd December, 1998

G.S.R.7.- In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986 namely:-

82. Environmental Standards for Gas Naphtha-based Thermal Power Plants.

- (i) Limit for emission of Nox
 - (a) For existing units – 150 ppm (v/v) at 15% excess oxygen.
 - (b) For new units with effect from 1-6-1999.

Total generation of gas turbine	Limit for Stack Nox emission [(v/v) at 15% excess oxygen]
(a) 400 MW and above	(i) 50ppm for the units burning natural gas. (ii) 100 ppm for the units burning naphtha
(b) Less than 400MW but upto 100 MW	(i) 75 ppm for the units burning natural gas (ii) 100 ppm for the units burning naphtha
(c) Less than 100 MW	100 ppm for units burning natural gas or naphtha as fuel
(d) For the plants burning gas in a conventional boiler.	100 ppm

- (iii) Stack height H in m should be calculated using the formula $H = 14 Q^{0.3}$, where Q is the emission rate of SO₂ in kg/hr, subject to a minimum of 30 mtrs.
- (iv) Liquid waste discharge limit

Parameter	Maximum Limit of concentration (mg/l except for pH and temperature)
pH	6.5-8.5
Temperature	As applicable for other thermal power plants
Free available chlorine	0.5
Suspended solids	100.0
Oil and grease	20.0
Copper (total)	1.0
Iron (Total)	1.0
Zinc	1.0
Chromium (total)	0.2
Phosphate	5.0

83. NOISE POLLUTION CONDITIONS: STANDARD EC CONDITIONS FOR THERMAL POWER SECTOR

A.) As per Standard EC Condition for Thermal Power Sector, 19th Nov 2018

1. The Ambient Noise levels shall meet the standards prescribed as per the Noise Pollution (Regulation and Control) Rules, 2000.

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2. Persons exposed to high noise generating equipment shall use Personal Protective Equipment (PPE) like earplugs/ ear muffs, etc.
3. Periodical medical examination on hearing loss shall be carried out for all the workers and maintain audiometric record and for treatment of any hearing loss including rotating to non-noisy/less noisy areas.

PROJECT SPECIFIC CONDITION:

B.) As per Env. (Protection) Third Amendment Rules, 2016, 7th March 2016

Noise Limits:-

- (a) Noise from gensets shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.
- (b) The acoustic enclosure shall be designed for minimum 25 dB(A) insertion loss or for complying with the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure or acoustic treatment. Under such circumstances, the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time between 10.00 PM-6.00 AM). The measurement for insertion loss may be done at different points at 0.5 m from the acoustic enclosure or room, and then averaged.

84 Temperature Limit for Discharge of Condenser Cooling Water from Thermal Power Plant.

- A New thermal power plants commissioned after June1, 1999.

New thermal power plants, which will be using water from rivers/lakes/reservoirs, shall install cooling towers irrespecting of location and capacity. Thermal power plants which will use sea water for cooling purpose, the condition below will apply.

- B New projects in coastal areas using sea water.

The thermal power plants using sea water should adopt suitable system to reduce water temperature at the final discharge point so that the resultant rise in the temperature of receiving water does not exceed 7°C over and over the ambient temperature of the receiving water bodies.

- C Guidelines for discharge point :

1. The discharge point shall preferably be located at the bottom of the water body at mid-stream for proper dispersion of thermal discharge.
2. In case of discharge of cooling water into sea, proper marine outfall shall be designed to achieve the prescribed standards. The point of discharge may be selected in consultation with concerned State Authorities/NIO.
3. No cooling water discharge shall be permitted in estuaries or near ecologically sensitive areas such as mangroves, coral reefs/spawning and breeding grounds of aquatic flora and fauna.

Annexure –II (A)

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

General Standards for Discharge of Environmental Pollutants Part- A: Effluents

(Published vide MOEF Notification dated 19.05.1993 under Env. (Protection) Rules, 1986 and amended vide Notification dated 31.12.1993)

Sl. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
	2	(a)	(b)	(c)	(d)
1.	Colour & odour	All efforts should be made to remove colour and unpleasant odour as far as practicable	-	All efforts should be made to remove colour and unpleasant odour as far as practicable	All efforts should be made to remove colour and unpleasant odour as far as practicable
2.	Suspended solids mg/l, Max.	100	600	200	(a) For process waste water-100 (b) For cooling water effluent 10 per cent above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve	-		(a) Floatable solids, max. 3mm. (b) Settleable solids max 850 micron.
4.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	Shall not exceed 5°C above the receiving water temperature.	-	-	Shall not exceed 5°C above the receiving water temperature.
6.	Oil and grease mg/l Max.	10	20	10	20
7.	Total residual chlorine mg/l Max.	1.0	-	-	1.0
8.	Ammoniacal nitrogen (as N) mg/l max.	50	50	-	50
9.	Total Kjeldahl nitrogen (as N); mg/l Max.	100	-	-	100
10.	Free ammonia (as NH ₃) mg/l, Max.	5.0	-	-	5.0

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Sl. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
	2	(a)	3	(c)	(d)
		(a)	(b)	(c)	(d)
11.	Biochemical oxygen demand (5 days at 20°C), mg/l Max.	30	350	100	100
12.	Chemical oxygen demand mg/l Max.	250	-	-	250
13.	Arsenic (as As) mg/l Max.	0.2	0.2	0.2	0.2
14.	Mercury (as Hg), mg/l Max.	0.01	0.01	-	0.01
15.	Lead (as Pb) mg/l, Max	0.1	1.0	-	2.0
16.	Cadmium (as Cd) mg/l, Max	2.0	1.0	-	2.0
17.	Hexavalent chromium (as Cr+6) mg/l, Max	0.1	2.0	-	1.0
18.	Total chromium (as Cr) mg/l, Max	2.0	2.0	-	2.0
19.	Copper (as Cu) mg/l, Max	3.0	3.0	-	3.0
20.	Zinc (as Zn) mg/l, Max	5.0	15	-	15
21.	Selenium (as Se) mg/l, Max	0.05	0.05	-	0.05
22.	Nickel (as Ni) mg/l, Max	3.0	9.0	-	5.0
23.	Cyanide (as CN) mg/l, Max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, Max	2.0	15	-	15
25.	Dissolved phosphates (as P) mg/l, Max	5.0	-	-	-

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

Sl. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
	2	(a)	3	(c)	(d)
		(a)	(b)	(c)	(d)
26.	Sulphide (as S) mg/l, Max	2.0	-	-	5.0
27.	Phenonic compounds (as C ₃ H ₃ OH) mg/l, Max	1.0	5.0	-	5.0
28.	Radioactive materials:				
	a) Alpha emitters UC/ml max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁷	10 ⁻⁷
	b) Beta emitters UC/ml max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁷	10 ⁻⁷
29.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent.	90% survival of fish after 96 hours in 100% effluent.	90% survival of fish after 96 hours in 100% effluent.	90% survival of fish after 96 hours in 100% effluent.
30.	Manganese (as Mn)	2 mg/l	2 mg/l		2 mg/l
31.	Iron (as Fe)	3 mg/l	3 mg/l		3 mg/l
32.	Vanadium (as V)	0.2 mg/l	0.2 mg/l		0.2 mg/l
33.	Nitrate Nitrogen	10 mg/l	-	-	20 mg/l

Notes:

- Regarding temperature limits for discharge of condenser cooling water from thermal power plants, MOEF vide Notification dated 22.12.1998 has stipulated that all new thermal power plants commissioned after June 1, 1999 which will be using water from river/ lake/ reservoir, shall install cooling towers irrespective of location and capacity.

ANNEXURE-II (B)

PLANT PERFORMANCE AND DESIGN PHILOSOPHY

LATEST MOEF&CC STANDARDS PUBLISHED VIDE GAZETTE NOTIFICATION
DATED

13.10.2017

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 13th October, 2017

G.S.R. 1265(E).—In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:—

1. **Short title and commencement.**—(1) These rules may be called the Environment (Protection) Amendment Rules, 2017.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in Schedule – I, after serial number 104 and the entries relating thereto, the following serial number and entries shall be inserted, namely:—

Sl. No.	Industry	Parameters	Standards	
1	2	3	4	
			Effluent discharge standards (applicable to all mode of disposal)	
*105	Sewage Treatment Plants (STPs)		Location	Concentration not to exceed
			(a)	(b)
		pH	Anywhere in the country	6.5-9.0
		Bio-Chemical Oxygen Demand (BOD)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	20
			Areas/regions other than mentioned above	30
		Total Suspended Solids (TSS)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	<50
	Areas/regions other than mentioned above	<100		
		Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml)	Anywhere in the country	<1000
*Metro Cities are Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune.				
Note :				
(i) All values in mg/l except for pH and Fecal Coliform.				
(ii) These standards shall be applicable for discharge into water bodies as well as for land disposal/applications.				
(iii) The standards for Fecal Coliform shall not apply in respect of use of treated effluent for industrial purposes.				
(iv) These Standards shall apply to all STPs to be commissioned on or after the 1 st June, 2019 and the old/existing STPs shall achieve these standards within a period of five years from date of publication of this notification in the Official Gazette.				
(v) In case of discharge of treated effluent into sea, it shall be through proper marine outfall and the existing shore discharge shall be converted to marine outfalls, and in cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 meters away from discharge point, then, the existing norms shall apply as specified in the general discharge standards.				
(vi) Reuse/Recycling of treated effluent shall be encouraged and in cases where part of the treated effluent is reused and recycled involving possibility of human contact, standards as specified above shall apply.				
(vii) Central Pollution Control Board/State Pollution Control Boards/Pollution Control Committees may issue more stringent norms taking account to local condition under section 5 of the Environment (Protection) Act, 1986".				

PART-A
VOLUME – V
GUARANTEES, PERFORMANCE TESTING
&
LIQUIDATED DAMAGES

GUARANTEES, PERFORMANCE TESTING & LIQUIDATED DAMAGES

1.00.00 GUARANTEES

1.01.00 GENERAL

1.01.01 The Bidder shall guarantee that each Genset and other Equipment (for which performance guarantees are applicable) shall meet the various guarantees covered in Technical Specifications.

1.01.02 Functional guarantees to be established by the Contractor are categorized as follows:

Category-I Guarantees : Guarantees, which attract liquidated damages, as indicated under Clause No. 1.02.00 of this volume.

Category-II Guarantees : Statutory Guarantees (Mandatory Guarantees), as indicated in Clause No. 1.03.00 of this volume.

Category-III Guarantees : Demonstration parameters and capabilities, as indicated in Clause No. 1.04.00 of this volume.

1.01.03 For Category I and II Guarantees, the Bidder shall furnish signed declarations in the manner prescribed in the relevant schedule of Forms and Procedures for these Guarantees. Demonstrable parameters for Category – III guarantees shall be indicated in an Annexure to be attached with the Guarantee Schedule.

1.01.04 Category-I Performance Guarantee Tests for each Genset shall be conducted separately. Liquidated damages on account of short fall, if any, in "Guaranteed Plant Performance" shall be levied separately for each Genset as identified in clause 3.00.00, of this Volume.

1.01.05 The quoted "Guaranteed Plant Performance", for each of the offered Genset, shall be deemed to include margins required for the error & inaccuracies of test instruments, method of test, human error and any other cause / uncertainties etc. The "Guaranteed Plant Performance" shall mean "Quoted Guaranteed Plant Performance" in the Guarantee Declaration Schedule without any adjustment for the tolerances.

1.01.06 The Contractor shall conduct Performance Guarantee Tests for each Genset to establish that the Quoted Performance Guarantees are met.

1.01.07 The Contractor shall also demonstrate all the specified Category – III guarantees as listed in this Volume during Acceptance Tests or Initial Operation.

1.01.08 The term "Performance Guarantees" shall have the same meaning and shall be synonymous to "Functional Guarantees". Similarly, the term "Performance Tests" shall have the same meaning and shall be synonymous to "Guarantee Tests" or "Acceptance Tests".

1.01.09 The Functional Guarantee Tests shall be carried out on specified fuel, which shall be witnessed by owner/client. Liquidated Damages shall be applicable on shortfall, if any, upon testing.

1.02.00 GUARANTEES ATTRACTING LIQUIDATED DAMAGES (CATEGORY-I)

1.02.01 The bidder shall guarantee and establish following Category – I guarantees for each Genset:

- (i) Net Power Output of genset at Base/Full Load.
- (ii) Net Heat Rate at LHV basis at 100% of Genset base load.

GUARANTEES, PERFORMANCE TESTING & LIQUIDATED DAMAGES

- 1.02.02
- (a) 'Measured Net Power Output' shall be as per IEC and as defined in Clause 3.02.00 of Volume-IV, Part A, Section-VI. Measured Net Power Output shall be corrected for the reference conditions (Clause 3.01.00 of Volume-IV, Part-A, Section-VI).
 - (b) Net Heat Rate as defined in Clause 3.03.00 of Volume-IV, Part-A, Section-VI, shall be computed for 100% Base Load with the Genset. These shall be corrected for the reference conditions (Clause 3.01.00 of Volume-IV, Part-A, Section-VI)
 - (c) Further, no tolerance on the test results will be permitted for the instrument inaccuracy, human error in measurement, method of testing or for any other cause/ uncertainties etc.

Note : Correction shall be applicable as specified under Cl. No.3.04.00 of Vol IV, Part-A, Section-VI

1.02.03 In case the contractor is not able to demonstrate the above mentioned "Guaranteed Plant Performance" even after the modifications or replacements within ninety (90) days of notification by the Employer, the Employer at his discretion will take actions as follows:

- a). Net Output within (-) 2.5 % : Accept the equipment/ system after levying of the Guaranteed Net Power Output. Liquidated Damages for the shortfall from the quoted Guaranteed Net power Output, as per Clause No.3.00.00 of this Volume.
- b). Net Output beyond (-) 2.5 % of the Guaranteed Net Power Output. : At it's discretion may either accept the equipment/ system after levying Liquidated Damages for the shortfall from the quoted Guaranteed Net Power Output, as per Clause No. 3.00.00 of this Volume or reject the equipment/ system and recover the payment already made.
- c). Net Genset heat rate at 100% of Genset base load within (+) 2 % of the Guaranteed Net Genset Heat Rate at 100% of the base load. : Accept the equipment/ system after levying liquidated damages as defined in clause no. 3.00.00 of this volume for the shortfall, if any, from the declared guaranteed " Net Genset Heat Rate at 100% of the module base load.
- d). Net Genset heat rate at 100% of Genset base load beyond (+) 2 % of the Guaranteed Net Genset Heat Rate at 100% of the module base load. : At it's discretion may either accept the equipment/ system after levying Liquidated Damages for the shortfall from the quoted Guaranteed "Net Genset heat rate at 100% of Genset base load, as per Clause No.3.00.00 of this Volume or reject the equipment/ system and recover the payment already made.

1.03.00 STATUTORY GUARANTEES

1.03.01 The Contractor shall establish following Statutory (Category II) Guarantees:

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- (i). NOx emission level of less than 80 ppm (dry volume basis corresponding to 15% excess oxygen in Engine exhaust) while operating at 100%, 90%,80%,70%,60% & 50% of Base Load Output.
- (ii). Noise level (near field and far field) of Engines, Generators/Alternators and including all the auxiliaries and their system at 100% and 80% of the base load of Gensets as per the applicable Norms.

1.03.02 No tolerance or allowance on the test results will be permitted for the instrument error & inaccuracy, human error, the method of testing or for any other cause. If the contractor is not able to demonstrate the specified Guarantees, even after the modifications / replacements within ninety (90) days of the notification by the Owner/Client, the Owner/Client will reject the equipment/ system and recover the payment already made.

1.04.00 DEMONSTRATION GUARANTEES

1.04.01 'Demonstration Guarantees' or 'Category III Guarantees' are required to be demonstrated during 'Initial Operation' or 'Guarantee Test' of the respective Genset Unit, Equipment or System, as the case may be. No tolerance or allowance on the test results will be permitted for Instrument error or inaccuracy, human error, the method of testing or any other cause.

1.04.02 If it is found that a Demonstration Guarantee is not met, the Contractor shall carry out all necessary modifications and or/ replacements to make the equipment/ system comply with the guaranteed requirements at no extra cost to the Owner/Client and reconduct the Guarantee Test(s) with Owner's/Client's consent. If the Contractor is not able to demonstrate the Guarantees, even after the modifications / replacements with in ninety (90) days of the notification by the Employer, the Employer will:

- a. Reject the equipment/ system/ plant and recover from the Contractor the payments already made.

OR

- b. Accept the equipment/ system/ plant after assessing the various parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Owner/Client. This amount shall be limited to the cost of replacement of equipment/system, replacement of which shall remove the deficiency so as to achieve the guarantee performance.

1.04.03 Following Category III Guarantees shall be demonstrated:

Plant Auxiliaries

(A) **Tube settler/clarifier unit** shall be guaranteed for design effluent capacity meeting the effluent quality as mentioned below-

SL No		
i.	Organic Matter	Less than 0.05 mg/l (Organic matter shall be tested as per KmnO4 method)
ii.	Iron Content	Less than 0.3 mg/l
iii.	Turbidity	Less than 10 NTU

(B) DMF shall be designed such that Turbidity at outlet of each filter shall not exceed 2 NTU with inlet turbidity of up to 10 NTU.

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C) SWRO Plant

- 1) Net permeate flow rate from each SWRO train shall be guaranteed.
- 2) For the design water quality and the permeate water capacity guaranteed, undiminished overall recovery of SWRO plant shall not be less than 35% up to the end of 3 years of operation without any replacement of membrane elements.
- 3) Performance of CEB, CIP, RO Flushing System and Cleaning system shall be demonstrated.
- 4) Design capacity of process equipment shall be guaranteed meeting the effluent capacity and the same shall not be less than specified capacity.
- 5) **Permeate water quality at the outlet of SWRO plant shall be as follows:**

A) Jacket cooling of engine

SI No	Parameter	Unit	Design Value
1)	pH	-	7.5 to 8.5
2)	TDS	ppm	Less than 100
3)	Hardness	dH	Max 10
4)	Chlorides	ppm	< 40
5)	Sulphates	ppm	< 50

B) Product water post remineralization (Service water)

SI No	Parameter	Unit	Design Value
1)	pH	-	7.5 to 8.5
2)	LSI	ppm	+0.3 to +0.5
3)	Calcium	ppm as CaCO ₃	Not less than 60
4)	Total alkalinity	ppm as CaCO ₃	Not less than 70

C) Potable quality after potabilisation system

SI No	Parameter	Unit	Design Value
1)	pH		7.0 to 8.0
2)	Conductivity	Micro siemens/cm	500 - 600
3)	M-alkalinity	ppm as CaCO ₃	100 -120
4)	P-alkalinity	ppm as CaCO ₃	Nil
5)	Silica	ppm as SiO ₂	0.1 – 0.2
6)	Chlorides	ppm as Cl	140 to 220

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SI No	Parameter	Unit	Design Value
7)	Sulphate	ppm as SO ₄	10 – 15
8)	Nitrate	ppm as NO ₃	Less than 0.5
9)	Magnesium	ppm as Mg	4 – 8
10)	Calcium	ppm as Ca	40 – 50
11)	Sodium	ppm as Na	120 - 150
12)	Boron	ppm as B	Less than 1
13)	TDS	ppm	Maximum 250
<p>Note: Reduction of TDS shall be achieved by blending suitable quantity of permeate from RO plant.</p>			

(6) **Package Air Conditioning (PAC) Unit**

(i) Specified temperature and humidity of conditioned space under worst ambient conditions.

(ii) Demonstration of rated capacity of PAC unit.

(7) **Fire Detection and Protection System**

Following shall be demonstrated at Shop:

Capacity, Head & Power consumption of fire water pumps.

(8) **Compressed Air System**

A Following shall be demonstrated at shop:

i) Capacity and discharge pressure of each air compressor.

B Following shall be demonstrated at site:

i) Parallel operation of air compressors

ii) Dew point of air at the outlet of air-drying plants of instrument air compressor.

iii) Pressure drop across the air drying plants of air compressors.

iv) Vibration level of air compressors, blowers of air-drying plant.

2.00.00 CONDUCTANCE OF PERFORMANCE / ACCEPTANCE TESTS

2.01.00 General

2.01.01 The responsibility of conducting the Performance Guarantee Test and establishing all the Guarantees and the Demonstration parameters / capabilities to the satisfaction of Employer, lies with the Contractor.

2.01.02 Functional Guarantees/Demonstration shall be conducted at Site by the Contractor in presence of the Employer/Client. The contractor's Commissioning and start-up

Engineer shall make the unit ready to conduct such test before start of initial operation. Such test shall be conducted along with the Initial Operations.

GUARANTEES, PERFORMANCE TESTING & LIQUIDATED DAMAGES

- 2.01.03 Performance Guarantee/ Acceptance Tests shall be carried out in accordance with specified Performance Test Codes and the requirements stipulated in Technical Specifications.
- 2.01.04 All special equipment, instruments, tools & tackles and other services required for the successful completion of the performance and guarantee tests as well as the demonstration tests shall be provided by the Contractor.
- 2.01.05 Owner/Client shall attend the Factory Acceptance Tests of all the Engines and Alternators.
- 2.02.00 Test Plan**
- 2.02.01 The Contractor shall prepare a Test Plan for the specified Acceptance Tests. It shall include following:
- a. Schedule of Activities for Preparation of Test, Pretest, Main Test, Evaluation and Preparation of Test Results.
 - b. Responsibilities of Parties involved.
 - c. Agreed and approved Test Procedure (duly signed by the authorized signatories of all the involved parties).
 - d. Details of Test Apparatus and Instrumentation including calibration reports.
 - e. Details of the Test Laboratories
- 2.02.02 The Contractor shall submit a consolidated Test Plan Document comprising the above to the Employer prior to start of Preparation for Performance Guarantee Test.
- 2.03.00 Test Procedure**
- 2.03.01 The Bidder shall necessarily include in his proposal proposed Performance Guarantee Test Procedure and Sample Calculation for evaluation of Performance Guarantees (Genset Net Power Output, Genset Net Heat Rate, Statutory Guarantees and Demonstration Guarantees). The successful bidder procedure submitted with the offer shall be discussed and agreed with the Employer. A detailed final PG Test Procedure in accordance with the applicable test codes, specification requirements and agreements reached prior to award of the Contract shall be prepared during detailed engineering. Detailed Test Procedure shall be finalized prior to the commencement of commissioning activities.
- 2.03.02 Test Procedure Document shall necessarily include all the details indicated below in the same sequence of appearance:
- a. Index
 - b. Objective of Test
 - c. Base Reference Conditions for the Guaranteed Performance
 - d. Guaranteed Performance, Statutory and Demonstration Guarantees
 - e. Applicable Performance Test Codes clearly indicating their applicability
 - f. Defined Test Boundaries
 - g. Applicable heat balance diagrams (HBDs) and Correction curves
 - h. PG Test Instrumentation Scheme
 - i. Calibration requirements for all instrumentation to be used in Performance Guarantee test
 - j. Measurement – frequency and method of recording the test readings
 - k. Sample collection, handling and analysis method

GUARANTEES, PERFORMANCE TESTING & LIQUIDATED DAMAGES

- l. Method of Plant Operation during Performance Guarantee Test
- m. Preparation for Test – Equipment Inspection, Cleaning, Making the equipment ready for test (installation of temporary test instrumentation etc.).
- n. Allowable variation in test conditions with respect to Design Reference Conditions
- o. Number of Test Runs, Duration of each Run, Number of Readings etc.
- p. Test Start and Stop requirements
- q. Data Acceptance and Rejection Criteria
- r. Sample Calculation
- s. Properties of Air, Flue Gas, Water, and Constituent Properties of RLNG to be used in evaluation of Test Results
- t. Format of Test Report

2.04.00 Performance Test Codes

2.04.01 Performance Guarantee/ Acceptance tests shall be conducted in accordance with the latest editions of relevant codes and standards for respective equipment/systems.

2.05.00 Measuring Equipment

2.05.01 For all measurements the Contractor shall provide the necessary instrumentation and test equipment. All the instruments will be calibrated by the Contractor before the tests in a reputed International Institute as approved by the Employer.

2.05.02 The calibration certificates shall be submitted to the Employer fifteen days prior to the tests. Batch calibration is not acceptable. The calibration shall be valid for the period mentioned in the certificate. At the time of acceptance test, calibration of instruments should be valid as per calibration certificate.

2.05.03 All costs associated with the supply, calibration, installation of test instruments and equipment shall be included in the bidder's scope.

2.08.00 NOx Measurement and Evaluation

2.08.01 Sampling, measurement and calculation method for NOx level in Engine exhaust shall be in accordance with US EPA Method 20. NOx measurement shall be established procedures such as the Non Dispersion Ultra Violet / Non Dispersive Infra Red Chemiluminescence type analyser. During measurement of NOx, oxygen content in the flue gas shall also be measured and the measured NOx value shall be corrected for 15 % excess oxygen in flue gas. Measured NOx value shall be corrected first for Dry Volume basis and the value thus obtained shall be corrected for 15% excess oxygen in the flue gas.

2.08.02 Detailed Method of NOx measurement, calculation method, sample calculation and evaluation of result shall be included in Test Procedure Document.

2.09.00 Test Reports

2.09.01 The Contractor shall prepare a Test Report, and submit to the Employer within a time period agreed in Test Plan.

2.09.02 The Test Report shall include following information:

- a. Performance Guarantees and Design Reference Conditions
- b. Description of Test Conducted
- c. Calculation for Test Condition and Correction for Design Reference Conditions

GUARANTEES, PERFORMANCE TESTING & LIQUIDATED DAMAGES

- d. Records of Readings taken during the Test
- e. Calculation for Test Condition and Correction for Design Reference Conditions
- f. Comparative Table of Corrected Test Results and Guarantee Performance Values
- g. Post Test uncertainty analysis
- h. Discussion on the Test and its Results
- i. Conclusion

3.00.00

LIQUIDATED DAMAGES FOR SHORTFALL IN GUARANTEED PERFORMANCE

3.01.00

The Liquidated Damages (LD) for shortfall in guaranteed performance, if any, shall be levied as indicated below:

S.No.	Description	Value
1.	Net Heat Rate at 100% of Engine load.	$\text{₹}600923(\text{INR}/\text{kCal}/\text{kwh}/\text{MW}) \times \Delta \text{HRg} \times Y/1000$
2.	Net Output of Genset INR/kW	$\text{₹} 314176 /(\text{KW}) \times \Delta Y$

Where:

ΔHRg	Increase in Net Heat Rate at 100% of Net output of Engine from guaranteed value in Kcal/Kwh.
Y	Guaranteed Net Power output of each Engine quoted by bidder in KW at 100% load. The net Output shall be restricted by the upper limit of the range prescribed for the plant.
ΔY	Decrease in Net Power Output of each Engine from guaranteed value in KW.

Note :

(i) Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantee shall not exceed twenty-five percent (25%) of the Contract Price.

(ii) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.

PART-A
VOLUME – VI
GENERAL TECHNICAL REQUIREMENTS (GTR)

GENERAL TECHNICAL REQUIREMENTS

1.00.00 INTRODUCTION

This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.

2.00.00 BRAND NAME

Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

3.00.00 BASE OFFER & ALTERNATE PROPOSALS

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.

4.00.00 COMPLETENESS OF FACILITIES

4.01.00 Bidders may note that this is an EPC Package contract. Plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure that a completely engineered plant shall be provided.

4.02.00 All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions.

All same standard components/ parts of same equipment provided shall be interchangeable with one another.

4.03.00 For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.

GENERAL TECHNICAL REQUIREMENTS

5.00.00 CODES & STANDARDS

5.01.00 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following :

- a) Indian Electricity Act
- b) Indian Electricity Rules
- c) Indian Explosives Act
- d) Indian Factories Act and State Factories Act
- e) Regulations of the Central Pollution Control Board, India
- f) Regulations of the Ministry of Environment & Forest (MoEF), Government of India
- h) Pollution Control Regulations of Department of Environment, Government of India
- i) State Pollution Control Board.
- (j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).
- (k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996
- (l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998
- (m.) Explosive Rules, 1983
- (n.) Petroleum Act, 1984
- (o.) Petroleum Rules, 1976,
- (p.) Gas Cylinder Rules, 1981
- (q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981
- (r.) Workmen's Compensation Act, 1923
- (s.) Workmen's Compensation Rules, 1924
- (t.) NVVN Safety Rules for Construction and Erection

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- (u.) NVVN Safety Policy
- (v.) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

- a) Bureau of Indian standards (BIS)
- b) Japanese Industrial Standards (JIS)
- c) American National Standards Institute (ANSI)
- d) American Society of Testing and Materials (ASTM)
- e) American Society of Mechanical Engineers (ASME)
- f) American Petroleum Institute (API)
- g) Standards of the Hydraulic Institute, U.S.A.
- h) International Organization for Standardization (ISO)
- i) Tubular Exchanger Manufacturer's Association (TEMA)
- j) American Welding Society (AWS)
- k) National Electrical Manufacturers Association (NEMA)
- l) National Fire Protection Association (NFPA)
- m) International Electro-Technical Commission (IEC)/ European Norm (EN)
- n) Expansion Joint Manufacturers Association (EJMA)
- o) Heat Exchange Institute (HEI)
- p) IEEE standard
- q) JEC standard

5.03.00 Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned

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elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

5.04.00 Deleted

5.05.00 In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.

5.06.00 DELETED

5.07.00 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of the Employer such changes and advise Employer of the resulting effect.

5.08.00 A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform is indicated in this volume and elsewhere in the specification.

6.00.00 **EQUIPMENT FUNCTIONAL GUARANTEE**

6.01.00 The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A & B of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract.

6.02.00 Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.

7.00.00 **DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS**

7.01.00 **DESIGN OF FACILITIES**

All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.

The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field

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assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.

7.02.00 MAINTENANCE AND AVILABILITY CONSIDERATIONS

Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.

Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspections of the Engine, Generator/Alternator, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours, clearly defining the spare parts and man-hour requirement for each stage.

Lifting devices i.e. hoists and chain pulley jacks etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist / crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.

8.00.00 DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR

8.01.00 Bidders may note that this is an **EPC Package contract**. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely engineered plant shall be provided in respect of mechanical, electrical and power systems, control & instrumentation, civil & structural works as per the scope.

Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated.

The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.

A comprehensive engineering and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in **Annexure-VI** to this volume of the Technical Specification.

GENERAL TECHNICAL REQUIREMENTS

8.03.00 The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:

8.03.01 A) **BASIC ENGINEERING DOCUMENTATION**

Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within three (3) weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

- i) Description of all the mechanical, electrical, control & instrumentation & civil systems.
- ii) Technology scan for each system / sub-system & equipment.
- iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options.
- iv) Optimisation studies including thermal cycle optimisation.
- v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins.
- vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.
- vii) Water Balance diagram, if applicable.
- viii) Operation Philosophy and the control philosophy of the Main Plant and Balance of Plant (BOP).
- ix) General Layout plan of the power station incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs.
- x) Basic layouts and cross sections of the Engine Hall & Utility Building, fuel oil area, transformer yard/switchyard and other areas included in the scope of the bidder.
- xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

The successful bidder shall furnish within two (2) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer.

GENERAL TECHNICAL REQUIREMENTS

B) DETAILED ENGINEERING DOCUMENTS

- i) General layout plan of the plant.
- ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.
- iii) Flow diagram, process and instrumentation diagrams along with write up and system description.
- iv) Start up curves for Engine-Generator/Alternator set.
- v) Piping isometric, composite layout and fabrication drawings.
- vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.
- vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors.
- viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like pumps, Air compressors etc.
- ix) Transient, hydraulic and thermal stress analysis of piping and system wherever applicable & input and output data alongwith stress analysis isometrics showing nodes.
- x) Thermal cycle information (heat balance diagrams and heat exchanger thermal calculations etc.).
- xi) Comprehensive list of all terminal points which interface with Employer's/Client's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details etc.
- xii) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.
- xiii) Protection system diagrams and relay settings.
- xiv) Cables schedules and interconnection diagrams.
- xv) Cable routing plan.
- xvi) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted

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instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.

- xvii) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points.
- xviii) Sequence and protection interlock schemes.
- xix) Type test reports, insulation co-ordination study report and power system stability study report.
- xx) Control system configuration diagrams and card circuit diagrams and maintenance details.
- xxi) Detailed DDCMIS system manuals.
- xxii) Detailed flow chart for digital control system.
- xxiii) Mimic diagram layout, Assignment for other application engineering.
- xxiv) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the scope of the bidder civil calculation sheets including structural analysis and design along with output results.

However, for civil related documents/drawings, it will be limited to interface inputs as applicable and defined elsewhere in specification.

- xxv) Model study reports wherever applicable.
- xxvi) Functional & guarantee test procedures and test reports.
- xxvii) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.

The Contractor while submitting the above documents/ drawings for approval/ reference as the case may be, shall mark on each copy of submission the reference letter along with the date vide which the submissions are made.

8.03.02 INSTRUCTION MANUALS

The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipment covered under the Contract within nine (9) months from the date of his acceptance of the

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Letter of Award. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in **Annexure-VI**. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.

A) ERECTION MANUALS

The erection manuals shall be submitted at least three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.

- a) Erection strategy.
- b) Sequence of erection.
- c) Erection instructions.
- d) Critical checks and permissible deviation/tolerances.
- e) List of tool, tackles, heavy equipments like cranes, dozers, etc.
- f) Bill of Materials
- g) Procedure for erection and General Safety procedures to followed during erection/installation.
- h) Procedure for initial checking after erection.
- i) Procedure for testing and acceptance norms.
- j) Procedure / Check list for pre-commissioning activities.
- k) Procedure / Check list for commissioning of the system.
- l) Safety precautions to be followed in electrical supply distribution during erection.

B) OPERATION & MAINTENANCE MANUALS

- a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers

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shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.

- b) The arrangement and contents of O & M manuals shall be as follows:
 - i) Chapter 1 - Plant Description : To contain the following sections specific to the equipment/system supplied
 - (a) Description of operating principle of equipment / system with schematic drawing / layouts.
 - (b) Functional description of associated accessories / controls. Control interlock protection write up.
 - (c) Integrated operation of the equipment alongwith the intended system. (This is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers).
 - (d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.
 - (e) Design data against which the plant performance will be compared.
 - (f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets.
 - (g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).
 - (h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).
- 2) Chapter 2.0 - Plant Operation: To contain the following sections specific to the equipment supplied
 - (a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.
 - (b) Limiting values of all protection settings.
 - (c) Various settings of annunciation/interlocks provided.
 - (d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.

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- (e) Do's and Don'ts related to operation of the equipment.
 - (f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.
 - (g) Parameters to be monitored with normal value and limiting values.
 - (h) Equipment isolating procedures.
 - (i) Trouble shooting with causes and remedial measures.
 - (j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.
 - (k) Routine Operational Checks, Recommended Logs and Records
 - (l) Change over schedule if more than one auxiliary for the same purpose is given.
 - (m) Preservation procedure on long shut down.
 - (n) System/plant commissioning procedure.
- 3) Chapter 3.0 - Plant Maintenance- To contain the following sections specific to the equipment supplied.
- (a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population.
 - (b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment.
 - (c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.
 - (d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.
 - (e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.
 - (f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.

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- (g) Long term maintenance schedules
- (h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.
- (i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation and quantity required for complete replacement.
- (j) Tolerance for fitment of various components.
- (k) Details of sub vendors with their part no. in case of bought out items.
- (l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NVVN.
- (m) List of mandatory and recommended spares along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.
- (n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.
- (o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.

8.03.03 After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer.

If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.

8.03.03 **PLANT HANDBOOK AND PROJECT COMPLETION REPORT**

8.03.03.01 **PLANT HANDBOOK**

The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipment and systems covering the complete project including

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- i) Design and performance data.
- ii) Process & Instrumentation diagrams.
- iii) Single line diagrams.
- iv) Sequence & Protection Interlock Schemes.
- v) Alarm and trip values.
- vi) Performance Curves.
- vii) General layout plan and layout of Engine Hall & Utility Building.
- viii) Important Do's & Don't's

The plant handbook shall be submitted within ten (10) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.

8.03.03.02 PROJECT COMPLETION REPORT

The Contractor shall submit a Project Completion Report at the time of handing over the plant.

8.03.04 DRAWINGS

- a) i) All documents submitted by the Contractor for Employer's/Client's review shall be in electronic form (soft copies) along with the desired number of hard copies as per **Annexure-VI**. The soft copies shall be uploaded by the vendors in C-folders, a web-based system of NVVN ERP, for which a username and password will be allotted to the new vendor by NVVN.

Similarly, the vendor can download the drawings/documents, approved/ commented by NVVN, through above site.

The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats.

- ii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per **Annexure-VI**.
- b) All documents/text information shall be in latest version of MS Office/MS Excel/PDF format as applicable.

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- c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.
- d) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.
- e) The drawings submitted by the Contractor (or their sub-vendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.

Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION".

Further, space shall be identified on each drawing for Approval stamp and electronic signature.

- f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.
- g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.
- h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some

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changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer/Client indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.

- i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.

Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.

- j) As Built Drawings

After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to "as built" conditions and submit no. of copies as per **Annexure VI**.

- k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.

- l) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.

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- m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.

8.03.05 e-Learning Package:

e-learning packages shall be supplied for the equipment / system for the following Engine-Generator/Alternator set & auxiliaries along with associated electrical and C&I system.

8.03.05.01 These packages shall be installed on the Learning Management Server (LMS) of NVVN/Power Management Institute (PMI), NTPC located at Noida. The Engineer- In-Charge (EIC) for the e-learning modules shall be from PMI.

1. The objective of the e-Learning package consisting of courses for erection, commissioning, operation and maintenance of equipment / system as specified above is to facilitate the employees to have first hand information / requirement with respect to above activities for the supplied equipment / system.
2. The bidder shall submit e-learning courses each for erection, commissioning, operation and maintenance of each of the equipment / system supplied as above.
 - a. The erection course(s) should include instructions on pre-checks, prerequisites, erection strategy, erection procedure etc.
 - b. The commissioning course(s) should include instructions on pre-commissioning, commissioning, initial operation etc.
 - c. The operation course(s) should include instructions on the permissive, interlocks, physical check ups, start up , shutdown and protections etc.
 - d. The maintenance course(s) should include instructions on predictive, preventive, breakdown and overhauling.

Depth of coverage of above courses shall be as specified for “**Instruction Manuals**” in above clauses. A literature on caution / safety while handling equipment / system for the above modules shall follow the description of the said equipment /system.

3. The e-Learning packages on equipment / system shall be installed by the vendor and shall be successfully test run in the presence of EIC or representative before acceptance by NVVN. The vendor will also give the master copy in form of Flash Drive/CD/DVD. The respective module for erection & commissioning shall be delivered and successfully test run at least three months before the scheduled start of the corresponding activity at site. The respective module for operation & maintenance shall be delivered and successfully test run at least three months before scheduled first synchronization of first unit.
4. **e-Learning course broad requirements:**
 - a. The courses shall be web based and mobile based Application type. It shall run on all possible versions of web browser like Internet Explorer, Google Chrome, Firefox etc. on

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Laptop/Desktop and shall be Smartphone/Tablet/Mobile responsive. The Mobile responsive courses shall run on Android, Windows Mobile, Blackberry, iOS etc.

- b. The courses shall support liquid/fluid page layout so that the entire screen gets adjusted to PC, Laptop, Smartphone/Mobile, Tablet and any other display devices.
- c. Course content text shall be in English language and be associated with a voiceover in English language with Indian accent.
- d. Courses shall be SCORM (Sharable Content Object Reference Model) compliant, version 1.2 which is compatible with LMS at PMI.
- e. Each course shall have every physical and functional detail of the equipment / system supplied.
- f. Each of the e-Learning course shall be based on multiple web pages and mobile pages with multiple modules.
- g. There shall be option for self-assessment test after every course. In case the user doesn't opt for self assessment test the user shall be able to go to the next course. There shall be no restriction in no. of times for repeating the assessments. All correct answers along with the answers marked by the users shall be displayed at the end of test/quiz.
- h. If Java and Flash, as applicable are not available in the system to run the package, then there shall be a prompt message for updation of the same.
- i. Each course shall have a self-running interactive content with navigation buttons containing forward, backward, pause, bookmark and menu options in the course window.
- j. The course shall contain chapter titled 'Introduction/overview' that explains the purpose of the course.
- k. The course content shall contain descriptive text shall be factual, specific, terse, clearly worded, and simply illustrative, so that the user can understand it.
- l. The system shall provide the user with the ability to select the information with a Cursor.
- m. The course menu should contain table of content linked to concerned pages. The user shall be given the capability to access all of the functions available on the system through a menu system. This shall consist of active buttons, which shall control a hierarchy of pull down/pop up menus. Menu shall appear quickly and exist only while a selection is being made. The user shall be given the capability to position the cursor or pointer on the menu item and use pointer device such as mouse to activate the function.
- n. Every course shall contain the 3D design/drawing/exploded view/360^o turn around view of the equipment/system, textual description of the equipment/system and its functionality with video (as applicable), animation and audio.
- o. The users shall be able to control audio sound level associated with the courses.
- p. Drawings / text in the courses shall be scalable (Zoom In/ Out).
- q. The user shall have the capability to record a **bookmark** to mark displayed information for later recall, whenever he accesses the same course next time.

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Notes:

1. e-learning Package of an equipment / system shall include e-learning courses for each of erection, commissioning, operation and maintenance of that equipment / system.
2. e-learning courses on erection, commissioning, operation and maintenance of an equipment / system shall include e-learning lessons/chapters/modules (as required) for erection, commissioning, operation and maintenance respectively of that equipment / system.
3. The vendor shall get the approval of one sample course from EIC before proceeding for further courses.

8.04.00 Not used

8.05.00 Engineering Co-ordination Procedure

8.05.01 The following principal coordinators will be identified by respective organizations at time of award of contract:

NVVN Engineering Coordinator (NVVN EC):

Name :

Designation :

Address :

a) Postal :

b) Telegraphic / e-Mail :

c) FAX : TELEPHONE :

Contractor's/ Vendor's Engineering Coordinator (VENDOR EC):

Name :

Designation :

Address :

a) Postal :

b) Telegraphic / e-Mail :

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c) FAX : TELEPHONE :

8.05.02 All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.

8.05.03 Contractor's/Vendor's Drawing Submission and Approval Procedure:

- a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NVVN's information/ interface and or review and approval are referred by the general term "drawings".
- b) Not used
- c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance.
- d) Not used
- e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.
- f) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission.
- g) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NVVN and their comments shall be forwarded within three (3) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories :

CATEGORY- I Approved

CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.

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CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.

CATEGORY -IV For information and records.

- h) Contractor shall resubmit the drawings approved under Category II, III & IVR within two (2) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**
- i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NVVN for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.
- j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.
- k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing.
- l) These comments will be taken care by the contractor while submitting the revised drawing.

The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.

8.06.00 ENGINEERING PROGRESS AND EXCEPTION REPORT

8.06.01 The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including

- a) A list of drawings/engineering information which remains unapproved for more than three (3) weeks after the date of first submission

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b) Drawings which were not submitted as per agreed schedule.

8.06.02 The draft format for this report shall be furnished to the Employer within two (2) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.

9.00.00 TECHNICAL CO-ORDINATION MEETING

9.01.00 The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.

9.02.00 The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing. The comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.

9.02.01 The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.

9.02.02 Should any drawing remain unapproved for more than four (4) weeks after its first submission, this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.

9.03.00 Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.

10.00.00 DESIGN IMPROVEMENTS

The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.

If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

11.00.00 EQUIPMENT BASES

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A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.

12.00.00 PROTECTIVE GUARDS

Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.

13.00.00 LUBRICANTS, SERVO FLUIDS AND CHEMICALS

13.01.00 All the first fill and one year's topping requirement of consumables such as greases, oils, lubricants, servo fluids / control fluids and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications into successful commissioning/initial operation and to establish completion of facilities shall be supplied by the contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

13.02.00 As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.

Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.

14.00.00 LUBRICATION

14.01.00 Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.

15.00.00 MATERIAL OF CONSTRUCTION

15.01.00 All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.

16.00.00 RATING PLATES, NAME PLATES & LABELS

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- 16.01.00 Each main and auxiliary item of plant shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.
- 16.02.00 Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.
- 16.03.00 Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.
- 16.04.00 Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.
- 16.05.00 Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support.
- 16.06.00 Valves and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire.
- 16.07.00 Safety and relief valves shall be provided with the following:
- a) Manufacturer's identification.
 - b) Nominal inlet and outlet sizes in mm.
 - c) Set pressure in Kg/cm^2 (abs).
 - d) Blowdown and accumulation as percentage of set pressure.
 - e) Certified capacity in kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute.
- 16.08.00 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.
- 16.09.00 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.

17.00.00 TOOLS AND TACKLES

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The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc.

The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. All the tools and tackles shall be of reputed make acceptable to the Employer.

18.00.00 COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES

All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.

19.00.00 PROTECTION AND PRESERVATIVE SHOP COATING

19.01.00 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be. The requirements for painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.

19.02.00 PRESERVATIVE SHOP COATING

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.

Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.

19.03.00 Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the

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Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.

19.04.00 All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.

19.05.00 All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.

19.06.00 Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications or as per standard approved practices for the location and climate condition of the plant.

20.00.00 QUALITY ASSURANCE PROGRAMME

20.01.00 The Contractor shall adopt suitable quality assurance programme to ensure that equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer or authorised representative after discussions before the award of the contract. Quality assurance programme shall generally cover the following:

- a. Organisation structure for the management and implementation of the proposed quality assurance programme
- b. Quality System Manual
- c. Design Control System
- d. Documentation Control System
- e. Qualification data for Bidder's key Personnel.
- f. Procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
- g. System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
- h. Control of non-conforming items and system for corrective actions and resolution of deviations.
- i. Inspection and test procedure both for manufacture and field activities.
- j. Control of calibration and testing of measuring testing equipments.
- k. System for Quality Audits.
- l. System for indication and appraisal of inspection status.
- m. System for authorizing release of manufactured product to the Employer.

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- n. System for handling storage and delivery.
- o. System for maintenance of records, and
- p. Furnishing of Quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment / component as per formats enclosed as Annex-I & Annex-II respectively.

21.00.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE

- 21.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.
- 21.02.00 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through C-folders, web based system of NVVN ERP for review and approval.
- 21.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities from receipt of materials/equipment at site.
- 21.04.00 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans. These documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/ Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and disposition.
- 21.05.00 The contractor shall submit to the Employer Field Welding Schedule for field welding activities. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.
- 21.06.00 The contractor shall have suitable Field Quality Organisation with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP) and Field Quality

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Management System for site activities. The contractor shall submit the details of proposed FQA setup (organisational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities

- 21.07.00 No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC).
- 21.08.00 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details/procedures.
- 21.09.00 All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer.
- 21.10.00 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.
- 21.11.00 Welding procedure qualification and Welder Qualification test results shall be furnished to the Employer for reference. However, where required by the Employer, tests shall be conducted in presence of Employer/ authorised representative.
- 21.12.00 For all pressure parts and high pressure piping welding, any statutory requirements for the equipments/systems shall be complied with.
- 21.13.00 Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.
- 21.14.00 No welding shall be carried out on cast iron components for repair.
- 21.15.00 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.
- 21.16.00 All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/ evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.
- All bar stock / forging of diameter equal to or greater than 50 mm shall be ultrasonically tested. In general all plates equal to or greater than 40mm and for pressure parts, plate of

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thickness equal to or greater than 25mm shall be ultrasonically tested unless otherwise as specified in respective specification.

- 21.17.00 The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.
- 21.17.00 a An indicative list of sub-vendors accepted by NTPC in the past for Corporate Awarded similar packages is enclosed for reference purpose.
- 21.18.00 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc. Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor..
- 21.19.00 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their subvendor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.
- 22.20.00 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. He shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.
- 21.21.00 Quality audit, surveillance, approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

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21.22.00 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

21.23.00 Repair/ rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

21.24.00 **Environmental Stress Screening**

Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be necessarily furnished for any sub vendors proposed for vendor assessment and approval for this contract. For other approved sub vendors of above mentioned systems, contractor shall furnish the test procedure for eliminating infant mortile components in case, if it is asked for by the employer before these items are offered for inspection / dispatched to site.

21.25.00 Software Reliability/ Quality Certification

Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAQMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β -version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.

22.00.00 QUALITY ASSURANCE DOCUMENTATION PACKAGE

22.01.00 The Contractor shall be required to submit the QA documentation in soft form as identified in respective quality plan with tick (\checkmark) mark.

22.02.00 Each QA documentation shall have a project specific cover sheet bearing name and identification number of equipment and including an index of its contents with page control on each document.

22.03.00 The QA Documentation file shall be progressively completed by the Supplier's sub- supplier to allow regular reviews by all parties during the manufacturing

22.04.00 The final Quality document will be compiled and issued at the final assembly place of equipment before dispatch.

22.05.00 Typical content of QA documentation shall be as follows:

- a. Quality Plans
- b. Material mill test reports on components as specified by the specification and approved Quality Plans.
- c. Manufacturer / works test reports and results for testing required as per applicable codes and standard referred in the specification and approved quality plans.

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- d. Nondestructive examination results including radiography interpretation reports.
- e. Heat Treatment Certificates or Records (Time – Temperature Chart)
- f. All the accepted Non-conformance Reports (major or minor), Deviations including complete technical details, repair procedure etc.
- g. Customer Hold Points (CHP)/ Inspection reports duly signed by QA personnel of the Employer and Contractor for the agreed Customer Hold Points.
- h. Certificate of Conformance (COC), wherever required.
- i. MDCC

22.06.00 Similarly, the contractor shall be required to submit two sets (CD), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

22.07.00 Before dispatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

22.07.01 If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

22.07.02 If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness in order to finalize the quality document (or applicable section) within a period compatible with the requirements of contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

22.07.03 If a decision is made to dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 03 weeks after the dispatch of equipment.

22.08.00 Transmission of QA Documentation

22.08.01 On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.

22.08.02 For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.

23.00.00 PROJECT MANAGER'S SUPERVISION

23.01.00 To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager of Employer and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.

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- 23.02.00** The work shall be performed under the supervision of the Project Manager. The scope of the duties of the Project Manager pursuant to the Contract will include but not be limited to the following:
- a. Interpretation of all the terms and conditions of these documents and specifications;
 - b. Review and interpretation of all the Contractor's drawing, engineering data, etc;
 - c. Witness or authorize his representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract;
 - d. Inspect, accept or reject any equipment, material and work under the contract;
 - e. Issue certificate of acceptance and/or progressive payment and final payment certificates;
 - f. Review and suggest modifications and improvement in completion schedules from time to time, and
 - g. Supervise Quality Assurance Programme implementation at all stages of the works.

24.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

- 25.01.00** The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.
- 24.02.00** The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.
- 24.03.00** The Contractor shall give the Project Manager/Inspector ten (10) working days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within ten (10) working days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports.
- 24.04.00** The Project Manager or Inspector shall within ten (10) working days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or

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shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

- 24.05.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.
- 24.06.00 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.
- 24.07.00 The inspection by Project Manager and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.
- 24.08.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 23.03.00, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.
- 24.09.00 All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NVVN. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.

25.00.00 ASSOCIATED DOCUMENT FOR QUALITY ASSURANCE PROGRAMME

	Document	Format No.
i.	Manufacturing Quality Plan	QS-01-QAI-P-09/F1-R0 (Annexure – I)
ii.	Field Quality Plan	QS-01-QAI-P-09/F2-R0 (Annexure – II)

26.00.00 PRE-COMMISSIONING AND COMMISSIONING FACILITIES

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- 26.01.00
- (a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Section-VI and elsewhere in the Technical Specifications.
 - (b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipment shall be operated integral with sub-systems and supporting equipment as a complete plant.
 - (c) All piping system shall be flushed, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness.
 - (d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
 - (e) The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule to be agreed by Employer.
 - (f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.

26.02.00 Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least eight (8) months prior to the schedule date of synchronization of 1st Genset. The chart should contain:

- (1.) Biodata including experience of the Commissioning Engineers.
- (2.) Role and responsibilities of the Commissioning Organisation members.

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- (3.) Expected duration of posting of the above Commissioning Engineers at site.

26.03.00

Initial Operation

- (a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.
- (b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 7 days continuously. During the period of initial operation of 7 days, the unit shall operate continuously at full rated load for a period not less than 72 hours.

The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.

The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.

- (c) Any loss of generation due to constraints attributable to the Employer shall be construed as Deemed Generation.
- (d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.

26.04.00

GUARANTEE TESTS

- a) The final tests as specified in Volume-V, Part-A and Part-B to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer/Client. The contractor's commissioning and start-up **Engineer** shall make the unit ready to conduct such test **before start of initial operation**. Such test **shall be conducted along with the** Initial Operations.
- b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.

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- c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.
- d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.
- e) The Guarantee tests and specific tests to be conducted on equipment have been brought out in detail elsewhere in the specifications.
- f) All the defects including those pointed out by the owner/client during the initial trial operation period and while conducting Performance Guarantee tests, shall be rectified by the contractor by the end of the initial trial operation period.

27.00.00 TAKING OVER

Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

28.00.00 TRAINING OF EMPLOYER'S PERSONNEL

28.01.00 The scope of service under training of Employer's personnel shall include a training module covering the areas of Engineering, Operation & Maintenance.

28.03.00 The scope of services under training shall also necessarily include training of Employer's Engineering personnel covering entire scope for the package. This shall cover all disciplines viz, Mechanical, Electrical, C&I , QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design software of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing erection, welding etc.

28.04.00 Total duration of the training shall be of 5 (five) man months. The break-up of the training period shall be as following-

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- i. 1 (One) Man month – At Engine manufacturers works/factory
- ii. 4 (four) Man months - Comprehensive training program consisting of classroom and plant visit of similar running plant for Employer's personnel for safe and efficient operation of the plant addressing the erection, commissioning, operation and maintenance aspects of the plant.

Accommodation with lodging and boarding and local conveyance at the place of training shall be provided to the Employer's personnel free of cost. Cost of journey to and from the place of training shall be borne by the Employer.

Details of the training shall be finalized during detail engineering of the project.

Note :

1. For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.
2. The total man months in each area shall be divided into suitable number of modules which shall be discussed and finalized during post award stage.

29.00.00 SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:

- i) Working platforms should be fenced and shall have means of access.
- ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.

30.00.00 NOISE LEVEL

The noise levels shall meet the MoEF&CC guidelines as enclosed at Annexure-IA of Volume IV, Part-A, Section-VI and requirements specified elsewhere.

31.00.00 PACKAGING AND TRANSPORTATION

- 31.01.00 All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection.
- 31.02.00 Bidder shall carry out detail study regarding the transport facilities available at the project location including port handling facilities for safe transportation of various equipment and system to the project site.
- 31.03.00 Before dispatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before dispatch of materials for transportation.

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31.04.00 The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

32.00.00 ELECTRICAL EQUIPMENTS/ENCLOSURES

32.01.00 All electrical equipment and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.

33.00.00 INSTRUMENTATION AND CONTROL

All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.

33.01.00 All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.

All scales and charts shall be calibrated and printed in Metric Units as follows:

1. Temperature - Degree centigrade (deg C)
2. Pressure - Kilograms per square centimetre (Kg/cm²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.
3. Draught- - Millimetres of water column (mm wc).
5. Flow (Gas) - Tonnes/ hour
7. Flow (Liquid) - Tonnes / hour
8. Flow base - 760 mm Hg. 15 deg.C
9. Density - Grams per cubic centimetre.

33.02.00 All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.

33.03.00 All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.

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34.00.00 ELECTRICAL NOISE CONTROL

The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).

35.00.00 SURGE PROTECTION FOR SOLID STATE EQUIPMENT

All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates etc. shall be submitted by the Bidder.

36.00.00 INSTRUMENT AIR SYSTEM

The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.

Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.

37.00.00 TAPPING POINTS FOR MEASUREMENTS

Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.

For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted.

The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.

- i) Temperature test pockets with stub and thermowell
- ii) Pressure test pockets

38.00.00 SYSTEM DOCUMENTATION

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The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I "Technical Data Sheets" Part of specifications. In addition to this, system documentation for DDCMIS shall include as a minimum to that specified elsewhere in the Technical Specification.

The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.

38.01.00 Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.

39.00.00 **MAINTENANCE MANUALS OF ELECTRONIC MODULES**

The Contractor shall have to furnish two (2 nos.) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further, the contractor shall furnish a set of operating manuals which should include block diagrams, make, model/type, details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.

40.00.00 **Make in India requirements**

a) The bidder shall follow Indian laws, regulations and standards. There shall not be any restriction in terms of compliance to codes & standards of foreign origin only. The compliance to equivalent/better Indian as well as other codes & standards, wherever available, shall also be acceptable.

b) The technologies/ products offered shall be environmentally friendly, consuming less energy, and safe, energy efficient, durable and long lasting under the prescribed operational conditions.

c) The bidder/its sub vendor/supplier shall ensure supply of spares, materials and technological support for the entire life of the project.

d) The bidder shall list out the products and components producing Toxic E-waste and other waste as specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled/ disposed of by the contractor and for this, the bidder has to establish recycling/ disposal unit as specified.

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e) The equipment/ material sourced from foreign companies will be tested in accredited labs in India before acceptance wherever such facilities are available. The testing shall be carried out in accordance with MOP extant order/guidelines.

f) The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.

g) All applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.

h) Wherever required, the foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of Employer.

i) To protect the security, integrity and reliability of equipment in this package, it is essential to remove vulnerabilities arising out of the possibility of cyber-attack through malware/ Trojans etc. embedded in imported equipment. This requirement shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in this package. Contractor shall comply all the requirements of Order No 25-11/6/2018-PG, dated 02/07/2020 (attached as Annexure-III), issued by Ministry of Power, Government of India and its subsequent amendments/revisions. Contractor shall furnish declaration of compliance of MOP order dated 02/07/2020 requirements with dispatch of equipment/ item. Further, Contractor shall furnish back up testing certificates, whenever Employer asks the same.

j) All equipment/materials/parts/items required in this package which are domestically manufactured with sufficient domestic capacity as identified in Annexure-I of MOP order dated 16/11/2021 including its subsequent revisions (copy attached as **Appendix-II and Appendix-III**) shall necessarily be sourced from the class-I local suppliers only as per the extant provisions of the Public Procurement (Preference to Make in India) Orders issued by DPIIT and MoP.

GENERAL TECHNICAL REQUIREMENTS

LIST OF CODES AND STANDARDS

Indian Standards	Title	International and Internationally recognised standards
IS:277	Galvanised steel sheets (plain or corrugated)	
IS:655	Specification for metal air duct	
IS:800	Code of practice for use of structural steel in general building construction	BS 449:1969 BS 5950 ASA A57, 1-1952
IS:807	Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists 6588 (Issued by Standards Association of Australia). DIN 120:1936 (Sheet 1) DIN 120:1936 (Sheet 2) 327 part-I, 1951 BS 466 part-II, 1960 BS 644:1960 BS 1757:1951 BS 2573:part-I:1960	Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev
IS:875	Code of practice for design loads (other than earthquake) for buildings and structures Leading standards (issued by Canadian Standard) DIN-1055-1955 (Issued by ASA)	National Building code of Canada (1953)-Part-IV Design section 4.1
IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)

GENERAL TECHNICAL REQUIREMENTS

IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965
IS:2825	Code for unfired vessels	
IS:1520	Horizontal centrifugal pumps for clear cold and fresh water	
IS:1600	Code for practice for performance of constant speed IC Engines for general purpose	
IS:1601	Specification for performance of constant speed IC Engines for general Purpose	
IS:1893	Criteria for earthquake resistant design of structures	
IS1978-1971	Line Pipe April 1969.	API Standards 5L
IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954
IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968
IS:2312	Propellant type Ventilation fans	
IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957
IS:3346	Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded	DIN 52612 (Deutscher Normenausschuss) ASTM C 163-1964 (American Society of Testing and

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	hot plate method)	materials) ASTM C 167-1974 ASTM C 177-1963
IS:3354	Outline dimensions for electric lifts.	
IS:3401	Silica gel	
IS:3588	Specification for electrical axial flow fans	
IS:3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)	
IS:3677	Unbonded rock and slag wool for thermal insulation	
IS:3815	Point hook with shank for general engineering purposes	BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)
IS:3895	Specification for monocrystallines semiconductor rectifier cells and stacks	
IS:3963	Roof extractor unit	
IS:3975	Mild steel wires, strips and tapes for armouring cables	
IS:4503	Shell and tube type heat Exchanger	
IS:4540	Specification for monocrystallines rectifier assembly equipment	
IS:4671	Expanded polystyrene for thermal insulation purpose	

GENERAL TECHNICAL REQUIREMENTS

IS:4736	Hot dip zinc coating on steel tubes	
IS:4894	Centrifugal fans	
IS:5456	Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)	
IS:5749	Forged ramshorn hooks	Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958
IS:6392	Steel pipe flanges	BS 4504 : 1969
IS:6524 Part-I	Code of practice for design of tower cranes Static and rail mounted	BS 2799 : 1956
IS:7098	Cross linked Polyethylene insulated PVC sheathed cables	Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524
IS:7373	Specification for wrought aluminium and aluminium sheet and strips	
IS:7938	Air receivers for compressed air installation	
ISO:1217	Displacement compressor-Acceptance test	
ASHRAE-33 heating coils.	Methods of testing for rating of forced circulation air cooling and air	
ASHRAE-52-76 matter.	Air cleaning device used in general ventilation for removing particle	
ASHRAE-22-72	Method of testing for rating of water cooled refrigerant condensers.	
ASHRAE 23-67 compressors.	Methods of testing for rating of positive displacement refrigerant	
ARI-450-6	Standard for water cooled refrigerant condensers.	

GENERAL TECHNICAL REQUIREMENTS

ARI-550	Standard for centrifugal water chilling packages.
ARI-410	Standard for forced circulation air cooling and air heating coils
ARI-430/435 BS:848 (Part-1,2)	Central station AHU/Application of Central Station AHU Fans
BS:400	Low carbon steel cylinders for the storage & transport of permanent gases.
BS:401	Low carbon steel cylinders for the storage & transport of liquified gases.
CTI Code ACT-105	Acceptance test code for Water Cooling Tower.
ANSI-31.5	Refrigerant piping
ASME-PTC- 23-1958	Atmospheric Water Cooling Equipment
AMCA A-21C	Test Code for air moving devices
API:618	Reciprocating Compressor for general refinery services.

HYDRAULIC INSTITUTE STANDARDS.

HYDRANT SYSTEM MANUALS OF TAC.

TAC MANUALS OF SPRAY SYSTEM

NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.

INDIAN EXPLOSIVES ACT.

INDIAN FACTORIES ACT.

STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.

CODE AND STANDARD FOR CIVIL WORKS (As applicable in scope of bidder)

Some of the applicable Standards, Codes and references are as follows:

Excavation & Filling

IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.

GENERAL TECHNICAL REQUIREMENTS

- IS: 4701 Code of practice for earth work on canals.
- IS: 9758 Guide lines for Dewatering during construction.
- IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.

Properties, Storage and Handling of Common Building Materials

- IS: 269 Specification for ordinary Portland cement, 33 grade.
- IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.
- IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.
- IS: 455 Specification for Portland slag cement.
- IS: 702 Specification for Industrial bitumen.
- IS: 712 Specification for building limes.
- IS: 808 Rolled steel Beam channel and angle sections.
- IS: 1077 Specification for common burnt clay building bricks.
- IS: 1161 Specification of steel tubes for structural purposes.
- IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C.
- IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B.
- IS: 1367 Technical supply conditions for Threaded fasteners.
- IS: 1489 Specification for Portland-pozzolana cement:
(Part-I) Fly ash based.
(Part-II) Calcined clay based.
- IS: 1542 Specification for sand for plaster.
- IS: 1566 Specification for hard-drawn steel wire fabric for concrete reinforcement.
- IS: 1786 Specification for high strength deformed bars for concrete reinforcement.
- IS: 2062 Specification for steel for general structural purposes.

GENERAL TECHNICAL REQUIREMENTS

IS: 2116	Specification for sand for masonry mortars.
IS: 2386 (Parts-I to VIII)	Testing of aggregates for concrete.
IS: 3150	Hexagonal wire netting for general purpose.
IS: 3495 (Parts-I to IV)	Methods of tests of burnt clay building bricks.
IS: 3812	Specification for fly ash, for use as pozzolana and admixture.
IS: 4031	Methods of physical tests for hydraulic cement.
IS: 4032	Methods of chemical analysis of hydraulic cement.
IS: 4082	Recommendations on stacking and storage of construction materials at site.
IS: 8112	Specification for 43 grade ordinary portland cement.
IS: 8500	Medium and high strength structural steel.
IS: 12269	53 grade ordinary portland cement.
IS: 12894	Specification for Fly ash lime bricks.

Cast-In-Situ Concrete and Allied Works

IS: 280	Specification for mild steel wire for general engineering purposes.
IS: 456	Code of practice for plain and reinforced concrete.
IS: 457	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures.
IS: 516	Method of test for strength of concrete.
IS: 650	Specification for standard sand for testing of cement.
IS: 1199	Methods of sampling and analysis of concrete.
IS: 1791	General requirements for batch type concrete mixers.
IS: 1838 (Part-I)	Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type).

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IS: 2204	Code of practice for construction of reinforced concrete shell roof.
IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.
IS: 2438	Specification for roller pan mixer.
IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
IS: 2505	General requirements for concrete vibrators, immersion type.
IS: 2506	General requirements for concrete vibrators, screed board type.
IS: 2514	Specification for concrete vibrating tables.
IS: 2645	Specification for Integral cement water proofing compounds.
IS: 2722	Specification for portable swing weigh batches for concrete. (single and double bucket type)
IS: 2750	Specification for Steel scaffolding.
IS: 2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
IS: 3025	Methods of sampling and test waste water.
IS: 3366	Specification for Pan vibrators.
IS: 3370 (Part I to IV)	Code of practice for concrete structures for the storage of liquids.
IS: 3414	Code of practice for design and installation of joints in buildings.
IS: 3550	Methods of test for routine control for water used in industry.
IS: 3558	Code of practice for use of immersion vibrators for consolidating concrete.
IS: 4014 (Parts I & II)	Code of practice for steel tubular scaffolding.
IS: 4326	Code of practice for earthquake resistant design and construction of buildings.

GENERAL TECHNICAL REQUIREMENTS

IS: 4461	Code of practice for joints in surface hydro-electric power stations.
IS: 4656	Specification for form vibrators for concrete.
IS: 4925	Specification for batching and mixing plant.
IS: 4990	Specification for plywood for concrete shuttering work.
IS: 4995 (Parts I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials.
IS: 5256	Code or practice for sealing joints in concrete lining on canals.
IS: 5525	Recommendations for detailing of reinforcement in reinforced concrete work.
IS: 5624	Specification for foundation bolts.
IS: 6461	Glossary of terms relating to cement concrete.
IS: 6494	Code of practice for water proofing of underground water reservoirs and swimming pools.
IS: 6509	Code of practice for installation of joints in concrete pavements.
IS: 7861	Code of practice for extreme weather concreting. (Parts I & II)
IS: 9012	Recommended practice for shot concreting.
IS: 9103	Specification for admixtures for concrete.
IS: 9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.
IS: 10262	Recommended guidelines for concrete mix design.
IS: 11384	Code of practice for composite construction in structural steel and concrete.
IS: 11504	Criteria for structural design of reinforced concrete natural draught cooling towers.
IS: 12118	Specification for two-parts poly sulphide.
IS: 12200	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams.

GENERAL TECHNICAL REQUIREMENTS

IS: 13311	Method of non-destructive testing of concrete.
Part-1	Ultrasonic pulse velocity.
Part-2	Rebound hammer.
SP:23	Handbook of concrete mixes
SP: 24	Explanatory Handbook on IS: 456-1978
SP: 34	Handbook on concrete reinforcement and detailing.

Precast Concrete Works

SP: 7(PartVI/	National Building Code- Structural design of prefabrication and systems building. Sec.7)
IS: 10297	Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units.
IS: 10505	Code of practice for construction of floors and roofs using pre-cast reinforced concrete units.

Masonry and Allied Works

IS: 1905	Code of Practice for Structural Safety of Buildings-Masonry walls.
IS: 2212	Code of Practice for Brickwork.
IS: 2250	Code of Practice for Preparation and use of Masonry Mortar.
SP: 20	Explanatory hand book on masonry code.

Sheeting Works

IS:277	Galvanised steel sheets (plain or corrugated).
IS: 459	Unreinforced corrugated and semi-corrugated asbestos cement sheets.
IS: 513	Cold-rolled carbon steel sheets.
IS: 730	Specification for fixing accessories for corrugated sheet roofing.
IS: 1626	Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings.
IS: 2527	Code of practice for fixing rain water gutters and down pipe for roof drainage.

GENERAL TECHNICAL REQUIREMENTS

IS: 3007	Code of practice for laying of asbestos cement sheets.
IS: 5913	Methods of test for asbestos cement products.
IS: 7178	Technical supply conditions for tapping screw.
IS: 8183	Bonded mineral wool.
IS: 8869	Washers for corrugated sheet roofing.
IS: 12093	Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets.
IS: 12866	Plastic translucent sheets made from thermosetting polyster resin (glass fibre reinforced).
IS: 14246	Specification for continuously pre-painted galvanised steel sheets and coils.

Fabrication and Erection of Structural Steel Work

IS: 2016	Specification for plain washers.
IS: 814	Specification for covered Electrodes for Metal Arc Welding for weld steel.
IS: 1852	Specification for Rolling and Cutting Tolerances for Hot rolled steel products.
IS: 3502	Specifications for chequered plate.
IS: 6911	Specification for stainless steel plate, sheet and strip.
IS: 3757	Specification for high strength structural bolts
IS: 6623	Specification for high strength structural nuts.
IS: 6649	High Tensile friction grip washers.
IS: 800	Code of practice for use of structural steel in general building construction.
IS: 816	Code of practice for use of Metal Arc Welding for General Construction.
IS: 4000	Code of practice for assembly of structural joints using high tensile friction grip fasteners.

GENERAL TECHNICAL REQUIREMENTS

IS: 9595	Code of procedure of Manual Metal Arc Welding of Mild Steel.
IS: 817	Code of practice for Training and Testing of Metal Arc Welders.
IS: 1811	Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes).
IS: 9178	Criteria for Design of steel bins for storage of Bulk Materials.
IS: 9006	Recommended Practice for Welding of Clad Steel.
IS: 7215	Tolerances for fabrication steel structures.
IS: 12843	Tolerance for erection of structural steel.
IS: 4353	Recommendations for submerged arc welding of mild steel and low alloy steels.
SP: 6 (Part 1 to 7)	ISI Hand book for structural Engineers.
IS: 1608	Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.
IS: 1599	Method of Bend Tests for Steel products other than sheet, strip, wire and tube
IS : 228	Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.
IS : 2595	Code of Practice for Radio graphic testing.
IS : 1182	Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.
IS : 3664	Code of practice for Ultra sonic Testing by pulse echo method.
IS : 3613	Acceptance tests for wire flux combination for submerged Arc Welding.
IS : 3658	Code of practice for Liquid penetrant Flaw Detection.
IS : 5334	Code of practice for Magnetic Particle Flaw Detection of Welds.

GENERAL TECHNICAL REQUIREMENTS

Plastering and Allied Works

- IS : 1635 Code of practice for field slaking of Building lime and preparation of putty.
- IS : 1661 Application of cement and cement lime plaster finishes.
- IS : 2333 Plaster-of-paris.
- IS : 2402 Code of practice for external rendered finishes.
- IS : 2547 Gypsum building plaster.
- IS : 3150 Hexagonal wire netting for general purpose.

Acid and Alkali Resistant Lining

- IS : 158 Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.
- IS : 412 Specification for expanded metal steel sheets for general purpose.
- IS : 4441 Code of practice for use of silicate type chemical resistant mortars.
- IS : 4443 Code of practice for use of resin type chemical resistant mortars.
- IS : 4456 Method of test for chemical resistant tiles.
(Part I & II)
- IS : 4457 Specification for ceramic unglazed vitreous acid resistant tiles.
- IS : 4832 Specification for chemical resistant mortars.
- Part I Silicate type
- Part II Resin type
- Part III Sulphur type
- IS : 4860 Specification for acid resistant bricks.
- IS : 9510 Specification for bitumasitc, Acid resisting grade.

Water Supply, Drainage and Sanitation

- IS : 458 Specification for concrete pipes.

GENERAL TECHNICAL REQUIREMENTS

IS : 554	Dimensions for pipe threads, where pressure tight joints are made on thread.
IS : 651	Specification for salt glazed stoneware pipes.
IS : 774	Flushing cisterns for water closets and urinals.
IS : 775	Cast iron brackets and supports for wash basins and sinks.
IS : 778	Copper alloy gate, globe and check valves for water works purposes.
IS : 781	Cast copper alloy screw down bib taps and stop valves for water services.
IS : 782	Caulking lead.
IS : 783	Code of practice for laying of concrete pipes.
IS : 1172	Basic requirements for water supply, drainage and sanitation.
IS : 1230	Cast iron rain water pipes and fittings.
IS : 1239	Mild steel tubes, tubulars and other wrought steel fittings.
IS : 1536	Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage.
IS : 1537	Vertically cast iron pressure pipes for water, gas and sewage.
IS : 1538	Cast iron fittings for pressure pipe for water, gas and sewage.
IS : 1703	Ball valves (horizontal plunger type) including float for water supply purposes.
IS : 1726	Cast iron manhole covers and frames.
IS : 1729	Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories.
IS : 1742	Code of practice for building drainage.
IS : 1795	Pillar taps for water supply purposes.
IS : 1879	Malleable cast iron pipe fittings.
IS : 2064	Code of practice for selection, installation and maintenance of sanitary appliances.

GENERAL TECHNICAL REQUIREMENTS

IS : 2065	Code of practice for water supply in building.
IS : 2326	Automatic flushing cisterns for urinals.
IS : 2470 (Part-I & II)	Code of practice for installation of septic tanks.
IS : 2501	Copper tubes for general engineering purposes.
IS : 2548	Plastic seat and cover for water-closets.
IS : 2556 (Part 1 to 15)	Vitreous sanitary appliances (vitreous china).
IS : 2963	Non-ferrous waste fittings for wash basins and sinks.
IS : 3114	Code of practice for laying of cast iron pipes.
IS : 3311	Waste plug and its accessories for sinks and wash basins.
IS : 3438	Silvered glass mirrors for general purposes.
IS : 3486	Cast iron spigot and socket drain pipes.
IS : 3589	Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter).
IS : 3989	Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories.
IS : 4111 (Part I to IV)	Code of practice for ancillary structure in sewerage system.
IS : 4127	Code of practice for laying of glazed stone-ware pipes.
IS : 4764	Tolerance limits for sewage effluents discharged into inland-surface waters.
IS : 4827	Electro plated coating of nickel and chromium on copper and copper alloys.
IS : 5329	Code of practice for sanitary pipe work above ground for buildings.
IS : 5382	Rubber sealing rings for gas mains, water mains and sewers.
IS : 5822	Code of practice for laying of welded steel pipes for water supply.

GENERAL TECHNICAL REQUIREMENTS

IS : 5961	Cast iron grating for drainage purpose.
IS : 7740	Code of practice for road gullies.
IS : 8931	Cast copper alloy fancy bib taps and stop valves for water services.
IS : 8934	Cast copper alloy fancy pillar taps for water services.
IS : 9762	Polyethylene floats for ball valves.
IS : 10446	Glossary of terms for water supply and sanitation.
IS : 10592	Industrial emergency showers, eye and face fountains and combination units.
IS : 12592	Specification for precast concrete manhole covers and frames.
IS : 12701	Rotational moulded polyethylene water storage tanks.
SP: 35	Hand book on water supply and drainage.
	-Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.

Doors, Windows and Allied Works

IS : 204	Tower Bolts
Part-I	Ferrous metals.
Part-II	Nonferrous metals.
IS : 208	Door Handles.
IS : 281	Mild steel sliding door bolts for use with padlocks.
IS : 362	Parliament Hinges.
IS : 420	Specification for putty, for use on metal frames.
IS : 1003 Part-I door	Specification for timber panelled and glazed shutters- (Part-I) shutters.
IS : 1038	Steel doors, windows and ventilators.
IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.

GENERAL TECHNICAL REQUIREMENTS

IS : 1341	Steel butt hinges.
IS : 1361	Steel windows for industrial buildings.
IS : 1823	Floor door stoppers.
IS : 1868	Anodic coatings on Aluminium and its alloys.
IS : 2202 (Part-II)	Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels
IS:2209	Mortice locks (vertical type).
IS:2553	Safety glass
IS:2835	Flat transparent sheet glass.
IS:3548	Code of practice for glazing in buildings.
IS:3564	Door closers (Hydraulically regulated).
IS : 3614	Fire check doors; plate, metal covered and rolling type.
IS:4351	Steel door frames.
IS:5187	Flush bolts.
IS:5437	Wired and figured glass
IS:6248	Metal rolling shutters and rolling grills.
IS:6315	Floor springs (hydraulically regulated) for heavy doors.
IS:7196	Hold fasts.
IS:7452	Hot rolled steel sections for doors, windows and ventilators.
IS:10019	Mild steel stays and fasteners.
IS:10451	Steel sliding shutters (top hung type).
IS:10521	Collapsible gates.

Roof Water Proofing and Allied Works

IS:1203	Methods of testing tar and bitumen.
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GENERAL TECHNICAL REQUIREMENTS

IS:1322	Specification for bitumen felts for water proofing and damp proofing.
IS:1346	Code of practice for water proofing of roofs with bitumen felts.
IS:1580	Specification for bituminous compound for water proofing and caulking purposes.
IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.
IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.

Floor Finishes and Allied Works

IS:1237	Specification for cement concrete flooring tiles.
IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.
IS:2114	Code of practice for laying in-situ terrazzo floor finish.
IS:2571	Code of practice for laying in-situ cement concrete flooring.
IS:3462	Specification for unbacked flexible PVC flooring.
IS:4971	Recommendations for selection of industrial floor finishes.
IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.
IS:8042	Specification for white portland cement.
IS:13801	Specification for chequered cement concrete flooring tiles.

Painting and Allied Works

IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.
IS:1477	Code of practice for painting of ferrous metals in buildings.
Part-I	Pretreatment.
Part-II	Painting.
IS:1650	Specification for colours for building and decorative finishes.

GENERAL TECHNICAL REQUIREMENTS

IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.
IS:2338	Code of practice for finishing of wood and wood based materials.
Part-I	Operations and workmanship
Part-II	Schedules
IS:2395	Code of practice for painting concrete, masonry and plaster surfaces.
Part-I	Operations and workmanship.
Part-II	Schedule.
IS:2524	Code of practice for painting of nonferrous metals in buildings.
Part-I	Pretreatment.
Part-II	Painting.
IS:2932	Specification of synthetic enamel paint, exterior, under-coating and finishing.
IS:2933	Specification enamel paint, under coating and finishing.
IS:4759	Code of practice for hot dip zinc coating on structural steel and other allied products.
IS:5410	Specification for cement paint
IS:5411 (Part-I)	Specification for plastic emulsion paint-for exterior use
IS:6278	Code of practices for white washing and colour washing.
IS:10403	Glossary of terms relating to building finishes.

Piling and Foundation

IS:1080	Code of practice for design and construction of simple spread foundations.
IS:1904	Code of practice for design and construction of foundations in Soils; General Requirements.
IS:2911	Code of practice for designs and construction of Pile foundations (Relevant Parts).
IS:2950	Code of practice for designs and construction of Raft (Part-I) foundation.
IS:2974	Code of practice for design and construction of machine

GENERAL TECHNICAL REQUIREMENTS

(Part-I TO V)	foundations.
IS:6403	Code of practice for determination of Allowable Bearing pressure on Shallow foundation.
IS:8009	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads.
Part-I	Shallow foundations.
Part-II	Deep foundations.
IS:12070	Code of practice for design and construction of shallow foundations on rocks.
DIN:4024	Flexible supporting structures for machines with rotating machines.
VDI:2056	Criteria for assessing mechanical vibrations of machines.
VDI:2060	Criteria for assessing rotating imbalances in machines.
Roads	
IRC:5	Standard specifications and Code of practice for road bridges, section-I general Features of Design.
IRC:14	Recommended practice of 2cm thick bitumen and tar carpets.
IRC:16	Specification for priming of base course with bituminous primers.
IRC:19	Standard specifications and code of practice for water bound macadam.
IRC:21	Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced).
IRC:34	Recommendations for road construction in waterlogged areas.
IRC:36	Recommended practice for the construction of earth embankments for road works.
IRC:37	Guidelines for the Design of flexible pavements.
IRC:56	Recommended practice for treatment of embankment slopes for erosion control.
IRC:73	Geometric design standards for rural (non-urban) highways.
IRC:86	Geometric Design standards for urban roads in plains.
IRC:SP:13	Guidelines for the design of small bridges & culverts.
IRC - Public-	Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.
IS:73	Specification for paving bitumen

GENERAL TECHNICAL REQUIREMENTS

Loadings

IS:875 (Pt. I to V)	Code of practice for design loads other than earthquake) for buildings and structures.
IS:1893	Criteria for earthquake resistant design of structures.
IS:4091	Code of Practice for design and construction of foundation for transmission line towers & poles.
IRC:6	Standard specifications & code of practice for road bridges, Section-II Loads and stresses.
M.O.T.	Deptt. of railways Bridge Rules.

Safety

IS:3696 (Part I & II)	Safety code for scaffolds and ladders.
IS:3764	Safety code for excavation work.
IS:4081	Safety code for blasting and related drilling operations.
IS:4130	Safety code for demolition of buildings.
IS:5121	Safety code for piling and other deep foundations.
IS:5916	Safety code for construction involving use of hot bituminous materials.
IS:7205	Safety code for erection on structural steelwork.
IS:7293	Safety code for working with construction machinery.
IS:7969	Safety code for handling and storage of building materials
IS:11769	Guidelines for safe use of products containing asbestos.
-	Indian Explosives Act. 1940 as updated.

Architectural design of buildings

SP:7	National Building Code of India
SP:41	Hand book on functional requirements of buildings (other than industrial buildings)

Miscellaneous

IS:802 (Relevant parts)	Code of practice for use of structural steel in overhead transmission line towers.
IS:803	Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.

GENERAL TECHNICAL REQUIREMENTS

IS:10430	Criteria for design of lined canals and liner for selection of type of lining.
IS:11592	Code of practice for selection and design of belt conveyors.
IS:12867	PVC handrails covers.
CIRIA	Design and construction of buried thin-wall pipes.
Publication	

REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION

The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.

Temperature Measurements

1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).
2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982.
3. Temperature measurement by electrical Resistance thermometers - IS:2806.
4. Thermometer - element - Platinum resistance - IS:2848.

Pressure Measurements

1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964).
b) Electronic transmitters BS:6447.
2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966.
3. Process operated switch devices (Pr. Switch) BS-6134.

Flow Measurements

Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II.

Measurement of fluid flow in closed conduits - BS-1042.

Electronic Measuring Instrument & Control Hardware/ Software

1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319.
2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974.

GENERAL TECHNICAL REQUIREMENTS

3. Compatability of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975.
4. Dynamic response testing of process control instrumentation ISA - S 26 (1968).
5. Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472.
6. Printed circuit boards - IPC TM - 650, IEC 326 C.
7. General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973.
8. Edge socket connectors - IEC 130-11.
9. Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.
10. Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980).
11. Direct acting electrical indicating instrument - IS:1248 - 1968 (R).
12. Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990.
13. Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989.
14. Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985.
15. Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.
16. Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985.
17. Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985.
18. IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984.
19. Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983.
20. Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978.
21. Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987.
22. Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.

GENERAL TECHNICAL REQUIREMENTS

Instrument Switches and Contact

1. Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000.
2. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600.

Enclosures

1. Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13).
2. Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972).
3. Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962.

Apparatus, enclosures and installation practices in hazardous area

1. Classification of hazardous area - NFPA 70 - 1984, Article 500.
2. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973.
3. Intrinsically safe apparatus - NFPA 493 1978.
4. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982.
5. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977.

Sampling System

1. Stainless steel material of tubing and valves for sampling system - ASTM 296-82, Grade 7 P 316.
2. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977.
3. Water and steam in power cycle - ASME PTC 19.11.
4. Standard methods of sampling system - ASTM D 1066-99.

Annunciators

1. Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979.
2. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472
3. Damp heat cycling test - IS:2106
4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78

GENERAL TECHNICAL REQUIREMENTS

Protections

1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989.
2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973.
3. Turbine water damage prevention - ASME TDP-1-1980.
4. Boiler safety interlocks - NFPA Section 85 B - 1984, 85 C - 1991.

UPS System

1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973.
2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983.
3. Surge withstand capability test - ANSI C 37.90 1 -1989.
4. Performance testing of UPS - IEC 146.
5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991.
6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985.
7. Printed Circuit Board - IPC TM 650, IEC 326C.
8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973.

Control Valves

1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985.
2. Face to face dimensions of control valves - ANSI B 16.00 - 1973.
3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2).
4. Codes for pressure piping - ANSI B 31.1
5. Control Valve leak class - ISA RP 39.6

Process Connection & Piping

1. Codes for pressure piping "power piping" - ANSI B 31.1.
2. Seamless carbon steel pipe ASTM - A - 106.
3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182.

GENERAL TECHNICAL REQUIREMENTS

4. Material for socket welded fittings - ASTM - A - 105.
5. Seamless ferritic alloy steep pipe - ASTM - A - 335.
6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234.
7. Composition bronze of ounce metal castings - ASTM - B - 62.
8. Seamless Copper tube, bright annealed - ASTM - B - 168.
9. Seamless copper tube - ASTM - B - 75.
10. Dimension of fittings - ANSI - B - 16.11.
11. Valves flanged and butt welding ends - ANSI - B - 16.34.

Instrument Tubing

1. Seamless carbon steel pipe - ASTM - A 106.
2. Material of socketweld fittings - ASTM - A105.
3. Dimensions of fittings - ANSI - B - 16.11.
4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1.

Cables

1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992.
2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815.
3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions through 2/83.
4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6).
5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977.
6. Rules for Testing insulated cables and flexible cables : VVDE - 0472
7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)
8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81.
9. Oxygen index and temperature index test - ASTM D - 2863.
10. Smoke density measurement test - ASTM D - 2843.
11. Acid gas generation test - IEC - 754 - 1.

GENERAL TECHNICAL REQUIREMENTS

12. Swedish Chimney test - SEN - 4241475 (F3).
13. Teflon (FEP) insulation & sheath test - ASTM D - 2116.
14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784.
15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I).

Cable Trays, Conduits

1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984.
2. -do- Test Standards. NEMA VE-1-1979.
3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTM A - 386-78.

Public Address System

1. Specifications for loud speakers - IS:7741 (Part-I, II and III)
2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301
3. Specification for Public Address Amplifiers - IS:10426.
4. Code of practice for outdoor installation of PA system - IS:1982.
5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881.
6. Basic environmental testing procedures for electronic and electrical items - IS:9000.
7. Characteristics and methods of measurements for sound system equipment - IS:9302
8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732
9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II)
10. Fittings for rigid steel conduits for electrical wiring - IS:2667
11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147.

Vibration Monitoring System

1. API 670 - 1994
2. BS : 4675 Part-2

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURING QUALITY PLAN	PROJECT : PACKAGE : CONTRACT NO.: MAIN-SUPPLIER:
	ITEM : SUB-SYSTEM:	QP NO.: REV.NO.: DATE: PAGE: OF....
MANUFACTURER'S NAME AND ADDRESS		

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER. N: NVVN P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NVVN SHALL IDENTIFY IN COLUMN "N" AS 'W'	DOC. NO.:
	REV..... CA1.....
MANUFACTURER/ SUB-SUPPLIER	FOR NVVN USE
SIGNATURE	REVIEWED BY
	APPROVED BY
	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1

1/1

ENGG. DIV./QA&I

ANNEXURE-II

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN	
	ITEM :	PROJECT :	PACKAGE :
	SUB-SYSTEM:	CONTRACT NO. :	MAIN-SUPPLIER:
		QP NO.:	
		REV. NO.:	
		DATE:	
		PAGE: OF	

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9. D*	10.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	SIGNATURE	FOR NVVN USE	DOC. NO.:	REV.....
<p>LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NVVN FQA, 'B' SHALL BE WITNESSED BY NVVN ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NVVN CHP STAGE)</p>					
				REVIEWED BY	APPROVED BY
					APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F2-RI

1/1

ENGG. DIV./QA&I

ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A	VOLUME – VI GENERAL TECHNICAL REQUIREMENT
		PAGE 69 OF 71

No.25-11/6/2018-PG
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg, New Delhi – 110001
Tele Fax: 011-23730264

Dated 02/07/2020

ORDER

Power Supply System is a sensitive and critical infrastructure that supports not only our **national defence, vital emergency services** including health, disaster response, **critical national infrastructure** including classified data & communication services, defence installations and manufacturing establishments, logistics services but also the **entire economy** and the **day-to-day life** of the citizens of the country. Any danger or threat to Power Supply System can have catastrophic effects and has the potential to cripple the entire country. Therefore, the Power Sector is a **strategic and critical sector**.

The vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment. Hence, **to protect the security, integrity and reliability of the strategically important and critical Power Supply System & Network** in the country, the following directions are hereby issued :-

(1) All equipment, components, and parts imported for use in the Power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards.

(2) All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MoP).

(3) Any import of equipment/components/parts from "prior reference" countries as specified or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these "prior reference" countries will require prior permission of the Government of India

(4) Where the equipment/components/parts are imported from "prior reference" countries, with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MoP).

This order shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in power supply system or any activity directly or indirectly related to power supply system.

This issues with the approval of Hon'ble Minister of State for Power and New & Renewable Energy (Independent Charge).


(Goutam Ghosh)
Director
Tel: 011-23716674

To:

1. All Ministries/Departments of Government of India (As per list)
2. Secretary (Coordination), Cabinet Secretariat
3. Vice Chairman, NITI Aayog
4. Comptroller and Auditor General of India
5. Chairperson, CEA
6. CMDs of CPSEs/Chairman of DVC & BBMB/MD, EESL/DG, NPTI/DG, CPRI/DG, BEE/
7. All ASs/JSs/EA, MoP

Copy:

1. PS to Hon'ble PM, Prime Minister's Office
2. PS to Hon'ble MOS(IC) for Power and NRE
3. Sr. PPS to Secretary(Power)

GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents		
	First submission and submission with major changes		
	▪ Layout (A0&A1 sizes)	4	-
	▪ Other Drawings/Documents (A0&A1 sizes)	2	-
	▪ P&ID (All sizes)	4	-
	a) Final drawings/documents (Directly to site)	6	2
	b) "As Built" Drawing/Documents (Directly to site)	6	2
	c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	2	2
2	Erection Manual (Directly to site)	4 sets	2
3	Operation & Maintenance manual	1 set	--
	i) First Submission		
	ii) Final Submission (Directly to site)	4 sets	2
4	Plant Hand Book	1	1
	i) First Submission		
5	Commissioning and Performance Test Procedure manual	1 set	--
	i) First Submission		
	ii) Final Submission (Directly to site)	4 sets	2

GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)

S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	--
	ii) Approved Copies (Direct to Site)	4 sets	2
7	Project Completion Report (Directly to site)	6 sets	2
8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	--
9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	--
10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1	--
	ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2
11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set	--
	ii) Approved copies (Direct to Site)	4 sets	2
12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2
13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2

Appendix II

No. A-1/2021-FSC-Part(5)
Government of India
Ministry of Power

Shram Shakti Bhawan, New Delhi
Dated: 16th November, 2021

ORDER

Subject: Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Power Sector.

Reference: Department for Promotion of Industry and Internal Trade (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 16.09.2020.

The Government of India, Department for Promotion of Industry and Internal Trade (DPIIT) issued Public Procurement (Preference to Make in India), Order 2017, for encouraging 'Make in India' and promoting manufacturing and production of goods and services in India with a view to enhancing income and employment. Subsequently, DPIIT vide order No. P-45021/2/2017-PP (BE-II) dated 4th June, 2020 and further vide order dated 16th September, 2020 have issued the revised Public Procurement (Preference to Make in India) Order 2017.

2. In light of the Public Procurement (Preference to Make in India) Order 2017, this Ministry had notified purchase preference (linked with local content) for Hydro and Transmission sectors vide Order No. 11/05/2018-Coord dated 20.12.2018, for Thermal sector vide Order dated 28.12.2018 and for Distribution sector vide Order dated 17.03.2020. Further, a combined order dated 04.04.2020 was also issued in supersession of all previous orders to indicate equipment/material/components for which there was sufficient local capacity and competition and also to indicate conditions for including suitably in the tenders to be issued by the procurers. In furtherance of Para 19 of the DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 04.06.2020, Ministry of Power (MoP) issued a revised comprehensive Order dated 28.07.2020 (Annexure-I amended by order dated 17.09.2020).

3. DPIIT Notification No. P-45021/2/2017-PP(BE-II) dated 16.09.2020 has further revised its order dated 04.06.2020. Therefore, in supersession of all the aforementioned orders including order No.10/1/2019-St.Th. (Part-II) dated 20.03.2020 issued by this Ministry, the following has been decided:

- i. For the purpose of this order, the definitions of various terms used in the order, and provisions relating to (i) Eligibility of 'Class-I local supplier'/'Class-II local supplier'/'Non-local suppliers' for different types of procurement, (ii) purchase preference (iii) exemption to small purchases and (iv) margin of purchase preference shall be the same as in DPIIT order dated 16.09.2020, referred to above and extracts of the same is given at **Appendix**.
- ii. In procurement of all goods and services or works in respect of which there is sufficient local capacity and local competition as in **Annexure-I**, only "Class-I local supplier" shall be eligible to bid irrespective of purchase value. "Class-I local supplier" is a supplier or service provider whose goods, services or works offered for procurement meets the Minimum Local Content (MLC) as prescribed in Annexure-I of this order. "Class-II local supplier" means a

supplier, as defined by DPIIT in its Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020.

- iii. In the procurement of all goods and services or works other than those listed in Annexure-I, only "Class-I local supplier" and "Class-II local supplier" as defined in the order of this Ministry herewith shall be eligible to bid in procurement undertaken by procuring entities, except when Global Tender Enquiry has been issued. In Global tender enquiries, "Non-local suppliers" shall also be eligible to bid along with "Class-I local suppliers" and "Class-II local suppliers". In procurement of all goods, services or works not covered by sub-para 3(ii) above, and with estimated value of purchases less than Rs. 200 crores, in accordance with Rule 161(iv) of GFR, 2017, Global Tender Enquiry(GTE) shall not be issued except with the approval of the competent authority as designated by Department of Expenditure.
- iv. For the purpose of this order, 'Works' means all works as per Rule 130 of GFR- 2017, and will also include 'turnkey works', Engineering, Procurement and Construction (EPC) contracts and service contracts including System Integrator (SI) contracts.
4. The list of items, in respect of which, local capacity with sufficient competition exists as per **Annexure-I**, will be reviewed at regular intervals with a view to increase number of items in this list and also to increase the MLC for each item, wherever it is less than 100%.
5. Purchase preference shall be given to local suppliers in accordance with **para 3A** of DPIIT Order dated 16.09.2020, and extracts of the same are given at **Appendix**.
6. Further, it has been decided to constitute a committee for independent verification of self-declarations and auditor's / accountant's certificates on random basis and in the case of complaints. The composition of the committee is given below:

Member (Planning), Central Electricity Authority (CEA)	Chairperson
Chief Engineer (PSETD), CEA	Member
Chief Engineer (HETD), CEA	Member
Chief Engineer (TETD), CEA	Member
Chief Engineer (DP&R), CEA	Member
As may be co-opted by CEA	External Expert
Chief Engineer (R&D), CEA	Convener

7. Further, it has also been decided to constitute a committee to examine the grievances in consultation with stakeholders and recommend appropriate actions to the Competent Authority in MoP. The composition of the Committee is given below:

Chairperson, CEA	Chairperson
Member (Hydro), CEA	Member

Member (Power System), CEA	Member
Member (Thermal), CEA	Convener

8. The complaint fee of Rs. 2 Lakhs or 1% of the value of the local item being procured (subject to maximum of Rs. 5 Lakhs), whichever is higher, shall be paid in the form of Demand Draft, drawn in favour of **PAO, CEA, New Delhi**. In case the complaint is found to be incorrect, the complaint fee shall be forfeited. In case, the complaint is upheld and found to be substantially correct, the deposited fee of the complainant would be refunded without any interest.

9. All other conditions, not stipulated in this order, shall be as laid down in the DPIIT's order No. P-45021/2/2017-PP (BE-II) dated 16.09.2020.

10. This order shall be applicable in respect of the procurement made by all attached or subordinate offices or autonomous bodies under the Government of India including Government Companies as defined in the Companies Act, and /or the States and Local Bodies making procurement under all Central Schemes/ Central Sector Schemes where the Scheme is fully or partially funded by the Government of India. The aforesaid orders shall also be applicable in respect of projects wherein funding of goods, services or works is by Power Finance Corporation (PFC) /Rural Electrification Corporation (REC) and any Financial Institution in which Government of India/ State Government share exists. This order shall be applicable to Tariff Based Competitive Bidding (TBCB) projects also. Procuring entities as defined in the DPIIT's Order dated 16.09.2020 are advised to revise their tender documents to fully comply with the said DPIIT's Order and the subsequent Orders that would be issued in this regard by DPIIT/ this Ministry from time to time.

11. All tenders for procurement by Central Government Agencies or the States and Local Bodies, as the case may be, have to be certified for compliance of the Public Procurement (Preference to Make in India) 'PPP-MII' Order by the concerned procurement officer of the Government Organization before uploading the same on the portal.

12. Exemption from meeting the stipulated local content is allowed as per clause 13 and 13A of PPP-MII Order dated 16.09.2020, if the manufacturer declares that the item is manufactured in India under a License from a foreign Manufacturer who holds Intellectual Property Rights (IPRs) and there is Transfer of Technology (ToT) with phasing to increase Minimum Local Content. For such items, if any CPSE under the administration of Ministry of Power requests exemption for any item, it shall be considered by Ministry of Power, on case to case basis.

13. In order to further encourage Make in India initiatives and promote manufacturing and production of goods and services in India, general guidelines as enclosed at **Annexure-II** may be adopted in an appropriate manner according to the circumstances by the procuring entities in their tendering process.

14. The procurers may specify the higher values of MLC than those specified in this Order in respect of goods, services or works covered in their tenders and award the weightage to the product of higher MLC for which they have to specify the criteria beforehand in their tender. The values given in Annexure-I are the minimum prescribed values for becoming a class-I local supplier for the products indicated therein.

15. This issues with the approval of Hon'ble Minister for Power and New & Renewable Energy.



(S. Majumdar)

Under Secretary to the Government of India
Tele No. 011- 23356938

To:

1. Secretary to Government of India (All Ministries/ Departments of Government of India) (As per list)
2. Secretary (Coordination), Cabinet Secretariat
3. CEO, NITI Aayog
4. Chief Secretaries of all States/ UTs
5. Comptroller and Auditor General of India
6. Secretary, DPIIT, Chairman of Standing Committee for implementation of Public Procurement Order, 2017
7. Director General, Bureau of Indian Standards (BIS)
8. Joint Secretary, DPIIT, Member-Convener of Standing Committee for implementation of Public Procurement Order, 2017
9. Chairperson, CEA
10. CMDs of CPSEs, CMD NLC, Chairman of DVC/ BBMB/ EESL, DGs of BEE/ CPRI/ NPTI
11. All Additional Secretaries/ JSs/ EA/ CE, Ministry of Power

Copy to:

Director (Technical), NIC with a request to publish the Order on the website of Ministry of Power

APPENDIX

Extracts of important provisions contained in DPIIT Order No. P-45021/2/2017-PP (BE-II) dated 16-09-2020

1. **Definitions** (*Para 2 of DPIIT order*):

'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order.

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for "Class-I Local supplier" under this Order.

'Non-Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order.

'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

'Margin of purchase preference' means the maximum extent to which the price quoted by a 'Class-I local supplier' may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

'Works' means all works as per Rule 130 of GFR- 2017, and will also include 'turnkey works'.

2. **Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement** (*Para 3 of DPIIT order*)

(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by 3(a) above, and with estimated value of purchases less than Rs 200 crores, in accordance with Rule 161(iv) of GFR, 2017 Global tender enquiry shall not

be issued except with the approval of competent authority as designated by Department of Expenditure.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

3. Purchase Preference (Para 3A of DPIIT order)

(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under.

(b) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are divisible in nature, the " Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

- i. Among all qualified bids, the lowest bid will be termed as L1 If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.
- ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder.

(c) In the procurements of goods or works, which are covered by para 3(b) of DPIIT Order No. P-45021/2/2017-PP(BE-II) dated 16-09-2021 and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

- iii. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1,
- iv. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.
- v. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.

(d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

4. Applicability in tenders where contract is to be awarded to multiple bidders (Para 3B of DPIIT order)-

In tenders where contract is to be awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

a) In case there is sufficient local capacity and competition for the items to be procured, as notified by the Nodal Ministry, only 'Class-I local supplier' shall be eligible to bid. As such, the multiple supplier who would be awarded the contract, should be all and only 'Class-I local suppliers'.

b) In other cases, 'Class-II local suppliers' and 'Non-Local suppliers' may also participate in the bidding process along with 'Class-I local supplier' as per provisions of this order.

c) If 'Class-I local supplier' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class-I local supplier' do not qualify for award of the contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class-I local supplier' over 'Class-II local supplier'/'Non-local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class-I local suppliers' taken in totality or considered for award of contract for at least 50% of the tendered quantity.

d) First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference subject to its meeting the prescribed criteria for award of contract as also the constraints of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier' falling within 20% margin of purchase preference, and so on.

e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulate in sub-paras above.

5. Exemption of small purchases (Para 4 in DPIIT order): Procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

6. Minimum Local Content (Para 5 in DPIIT order): The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the local content requirement is minimum 20%. Nodal Ministry/Department may prescribe only a higher percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/'Class-II local supplier'. For the item for which Nodal Ministry/Department has not prescribed higher minimum local content notification under the order, it shall be 50% and 20% for 'Class-I local supplier'/'Class-II local supplier' respectively.

7. Vide DPIIT OM No. P-45021/102/2019-BE-IIPart(1) (E-50310) dated 4.03.2021 services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. shall not be considered as local value addition. Bidders offering imported products will fall under the category of Non- local suppliers. They can't claim themselves as Class-I local suppliers/Class-II local suppliers by claiming the services such as transportation, insurance, installation, commissioning, training and after sales service support like AMC/CMC etc. as local value addition.
8. **Margin of Purchase Preference** (*Para 6 of DPIIT order*): The margin of purchase preference shall be 20%.
9. **Specifications in Tenders and other procurement solicitations** (*Para 10 of DPIIT order*):
 - a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.
 - b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.
 - c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.
 - d. **Reciprocity Clause:**
 - i. When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of barring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc. it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.
 - ii. Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all the items related to that nodal Ministry/Department, except for the list of items published by the Ministry/Department permitting their participation.
 - iii. The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchase on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/Department.
 - iv. State Governments should be encouraged to incorporate similar provisions in their respective tenders.
 - v. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.
 - e. Specifying foreign certification/ unreasonable technical specifications/ brands/ models in the bid document is restrictive and discriminatory practice against local

suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/ or for any other reason, the same shall be done only after written approval of Secretary of Department concerned or any other authority having been designated such power by the Secretary of the Department concerned.

- f. "All administrative Ministries/Departments whose procurement exceeds Rs. 1000 Crore per annum shall notify/ update their procurement projections every year, including those of PSEs/PSUs, for the next 5 years on their respective website."

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
46	DC system (DC Battery & Battery Charger)	60
47	AC & DC Distribution Board	60
48	Indoor Air Insulated Switchgear (AIS) upto 33 kV	60
49	Poles (PCC, PSCC, Rolled Steel Joist, Rail Pole, Spun, Steel Tubular)	60
50	Material for Grounding/earthing system	60
51	Illumination system	60
52	Overhead Fault Sensing Indicator (FSI)	50
53	Power Quality Meters	50
54	Auxiliary Relays	50
55	Load Break Switch	50
(B) Hydro Sector		
56	Hydro Turbine & Associated equipment	
	a) Francis Turbine	60
	b) Kaplan Turbine	60
	c) Pelton Turbine	50
57	Main Inlet Valve & Associated Equipment	60
58	Penstock Protection Valve and Associated Equipment	60
59	Governing system & Accessories	60
60	Generator for Hydro Project & Associated Equipment	60
61	Static Excitation System	60
62	Workshop Equipment	60
63	Cooling Water System	60
64	Compressed Air System	60
65	Drainage/Dewatering System	60
66	Fire Protection System	60
67	Heating, Ventilation & Air Conditioning System (HVAC)	60
68	Oil Handling System	60
69	Mechanical Balance of Plant (BOP) Items	60
(C) Thermal Sector		
Boiler Auxiliaries		
70	Air Pre-Heater	60
71	Steam Coil Air Pre Heater (SCAPH)	60
72	Steam soot blowers [wall blowers & Long Retractable Soot Blower (LRSB)]	60
73	Auxiliary Steam Pressure Reducing & Desuperheating (PRDS)	60
74	Fuel oil system	60
75	Seal air Fan	60
76	Ducts and dampers	60
77	Duct expansion joints	60
78	Blowdown tanks	60
79	Coal burners and oil burners	60
80	Coal mills	60
81	Gear Box of Coal Mill	50
82	Coal feeders	60
83	Primary Air Fans	60
84	Forced Draft Fans	60
85	Induced Draft Fans	60
86	Forced Draft (FD)/Induced Draft (ID)/ Primary Air (PA) Fan Servo Motor Assembly	50
87	Tubes (Carbon Steel)	50
88	Steam pipes (Carbon Steel)	50
89	Steam drum	50
90	Separator	50
91	Selective Catalytic Reduction (SCR)	50

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
	Electro-Static Precipitators (ESPs)	
92	Casing	60
93	Electrodes	60
94	Rapping System	60
95	Hopper Heaters	60
96	Transformer Rectifiers	60
97	Insulators	60
	Turbine & Auxiliaries	
98	Turbine (High Pressure/Intermediate Pressure/Low Pressure)	50
99	Condensate Extraction Pumps	60
100	Condenser On line Tube Cleaning System (COLTC)	60
101	Debris filters	60
102	Deaerator	60
103	Drain Cooler and Flash Tank	60
104	ECW Pump	50
105	Plate Heat Exchanger	50
106	Self-cleaning filters	50
107	Condensate Polishing Units (CPUs)	60
108	Chemical Dosing System	60
109	Oil Filter	60
110	Gland Steam Condenser	60
111	Oil Purifying Centrifuge	50
112	Water Cooled Condenser	50
113	Boiler Feed Pumps (BFPs)	50
	Generator and Auxiliaries	
114	Generator (including Seal Oil System, Hydrogen Cooling System, Stator water cooling system)	60
	Electrical Works	
115	Control and metering equipment	60
	Control & Instrumentation System (C&I System)	
116	Thermocouples	50
117	Measuring instruments [Resistance Temperature Detectors (RTDs)], Local gauges	50
118	Actuators (Pneumatic and conventional electric)	50
119	Interplant Communication/ Public Address (PA) system except IP based	50
	Coal Handling Plant	
120	Conveyors	60
121	Wagon Tippler	60
122	Side Arm Charger	60
123	Paddle feeder	60
124	Crushers & Screens	60
125	Dust suppression (dry fog & plain water) system	60
126	Air Compressors	50
127	Magnetic separators & metal detectors	50
128	Coal Sampling System	60
129	Stacker cum reclaimer	60
130	Belt weighing & monitoring system.	60
131	Wheel & axle assembly (without bearings) for Bottom Opening Bottom Release (BOBR) Wagons	60
	Ash Handling System	
132	Clinker grinder	60
133	Water jet ejectors	60
134	Scraper chain conveyor	60
135	Dry fly ash vacuum extraction system	60
136	Pressure pneumatic conveying system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
137	Ash water & ash slurry pumps	60
138	Compressors, air dryers & air receivers	50
139	Ash water recovery system	60
	Raw Water Intake & Supply System	
140	Travelling water screens	60
141	Raw water supply pumps	60
142	Valves, RE joints etc.	60
	Water Treatment System and Effluent Treatment System	
143	Clarification plant	60
144	Filtration plant	60
145	Ultra filtration plant	50
146	Reverse Osmosis (RO) plant and its membrane	55
147	De-Mineralised water plant (DM Plant)	60
148	Chlorination plant	60
149	Chemical dosing system	60
150	Effluent Treatment Plant	60
	Circulating Water (CW) & Auxiliary Circulating Water (ACW) System	
151	CW & ACW Pumps	60
152	Butter Fly (BF) valves, Non-return Valves (NRVs) etc.	60
153	Rubber Expansion (RE) joints	60
154	Air release valves	60
	Cooling Towers (NDCT/ IDCT)-Natural-Draft and Induced Draft Cooling Tower	
155	Water Distribution System	60
156	Spray nozzles	60
157	Packing	60
158	Drift eliminators	60
159	Cooling Tower (CT) Fans (for Induced Draft Cooling Towers IDCT)	60
160	Gear boxes, shafts & motors (for IDCT)	60
	Air Conditioning & Ventilation System	
161	Split & window air conditioners	60
162	Chilling/ condensing unit [upto 500 ton of refrigeration(TR)]	55
163	Air Handling Unit (AHU) and Fresh air unit	60
164	Cooling Towers	60
165	Air Washing Units (AWUs), axial fans, roof extractors	60
166	Ducts, louvers & dampers	60
	Flue Gas Desulphurization (FGD)	
167	Spray Nozzles,	50
168	Spray header	50
169	Oxidation Blowers	50
170	Limestone wet Ball Mill	50
171	Slurry Handling Pumps for FGD system	50
172	Booster Fans for FGD system	50
173	Carbon Steel Ducts and Dampers for FGD	60
174	Storage Tanks and Silos	60
175	Process Water Pump for FGD system	50
	(D) Other Common Items	
	Fire protection and detection system	
176	Motor driven fire water pumps	60
177	Diesel engine driven fire water pumps	60
178	Hydrant system for the power plant.	60
179	High velocity water spray system	60
180	Medium velocity water spray system	60
181	Foam protection system	60
182	Inert gas flooding system	60

Sl. No.	Electrical Equipment for Generation, Transmission and Distribution sectors with sufficient local capacity and competition	Class-I Local Supplier (Minimum Local Content (%))
183	Fire tenders	60
184	Portable fire-extinguishers	60
185	Cranes, EOT cranes, gantry crane & chain pulley blocks etc.	60
186	Elevator	60

(E) Minimum Local Content percentages in Engineering, Procurement & Construction (EPC) / Turnkey project

In case the contract is awarded through the EPC route, the contractor should comply with the requirement of MLC for individual items as listed in Annexure-I and should purchase these items only from Class-I Local supplier. In addition, MLC for complete EPC project may also be prescribed as below:

	(1) Package Based Works	Minimum Local Content (%)
1	Boiler	60
2	TG System (Water Cooled Condenser)	60
3	Ash Handling Plant	60
4	Coal Handling Plant	60
5	Electro-static Precipitator (ESP)	60
6	Circulating Water (CW) System	60
7	Cooling Tower	60
8	Water Treatment System	60
9	Air Conditioning System (below 500TR)	60
10	Flue Gas Desusphurisation (FGD) System	60
11	Station Control & Instrumentation (C&I)	50
12	Hydro Power Projects (Electro-Mechanical Works)	60
	Gas based generation	
	Overall Gas Turbine Package (on finished Product basis)	
13	< 44 MW	60
14	44 – 145 MW	50
	Overall Combined Cycle Gas Turbine (CCGT) Package (on finished Product basis)	
15	< 44 MW	60
16	44 – 145 MW	60
17	> 150 MW	60
	(2) Project as a whole	
1	Works and service contracts in Power Sector	60
2	Transmission Line with Conventional conductors (ACSR, AAAC, AL-59 etc.)	60
3	Transmission Line with High temperature Low Sag (HTLS) conductors	60
4	HVAC Substation Air Insulated (AIS)	60
5	HVAC Substation Gas Insulated (GIS)	60
6	HVDC Substation	60
7	Distribution Sector	60

Annexure-II

General guidelines to be adopted selectively in an appropriate manner by the procuring entities in their tender documents.

1. The bidder shall have to be an entity registered in India in accordance with law.
2. The bids shall be in the language as prescribed by the tenderer/procurer.
3. The bids shall be in Indian Rupees (INR) (in respect of local content only).
4. Indian subsidiaries of foreign bidders shall have to meet the qualifying criteria in terms of capability, competency, financial position, past performance etc.
5. The bidder shall follow Indian laws, regulations and standards.
6. To be eligible for participation in the bid, foreign bidders shall compulsorily set up their manufacturing units on a long term basis in India as may be specified by the tenderer/ procurer.
7. Similar or better technology than the technology offered in respect of material, equipment and process involved shall be transferred to India. Along with the transfer of technology, adequate training in the respective field shall also be provided.
8. Country of origin of the equipment/material shall be provided in the bid.
9. For supply of equipment / material from the country of origin other than India, the bidder shall submit performance certificate in support of satisfactory operation in India or a country other than the country of origin having climatic and operational conditions including ambient temperature similar to that of India for more than _____ years (to be specified by the procurer).
10. The technologies/ products offered shall be environmental friendly, consuming less energy, safe, energy efficient, durable and long lasting under the prescribed operational conditions.
11. The supplier shall ensure supply of spares, materials and technological support for the entire life of the project.
12. The manufacturers/ supplier shall list out the products and components producing Toxic E-waste and other waste as may be specified. It shall have an Extended Producers Responsibility (EPR) so that after the completion of the lifecycle, the materials are safely recycled / disposed of by the Manufacturer/ supplier and for this, the Manufacturer/supplier along with procurer has to establish recycling / disposal unit or as may be specified.
13. Minimum Local Content requirement for goods, services or works shall be in accordance with the conditions laid down in respective Order(s) of the sectors on Public Procurement (Preference to Make in India) to provide for purchase preference (linked with local content).

14. The equipment/ material sourced from foreign companies may be tested in accredited labs in India before acceptance wherever such facilities are available.
15. The Tender fee and the Bank Guarantee (BG) shall be in Indian Rupees only.
16. The bidder shall have to furnish a certificate regarding cyber security/safety of the equipment/process to be supplied/services to be rendered as safe to connect.
17. Applicable safety requirements shall be met. Regular safety audit shall be carried out by the manufacturer/ supplier.
18. Statutory laws/regulations including the labour and environmental laws shall be strictly complied with during supply, storage, erection, commissioning and operation process. A regular compliance report shall be submitted to the procurer/appropriate Authorities.
19. Formation of new joint venture in India shall be permitted only with the Indian companies.
20. Tendering by the agent shall not be accepted.
21. In case local testing is not considered necessary by the procurer, the original test report in the language prescribed by the procurer may be accepted. The translated test report shall not be accepted unless it is notarised.
22. Certification/compliance as per the Indian Standards/ International Standards/ Indian Regulations/ specified Standards shall be mandatory, where ever applicable.
23. Quality assurance of the product shall be carried out by the procurer or an independent third party agency appointed by the procurer. Manufacturing Quality Plan as approved by the procurer shall be followed by the manufacturer/supplier.
24. Wherever required by the procurer, foreign supplier shall establish fully functional service centers in India and shall keep spares/material locally for future needs of utilities.
25. Arbitration proceedings shall be instituted in India only and all disputes shall be settled as per applicable Indian Laws.

No. P-45021/2/2017-PP (BE-II)-Part(4)Vol.II
Government of India
Ministry of Commerce and Industry
Department for Promotion of Industry and Internal Trade
(Public Procurement Section)

Vaniya Bhawan, New Delhi
Dated: 19 July, 2024

To

All Central Ministries/Departments/CPSUs/All concerned

ORDER

Subject: Public Procurement (Preference to Make in India), Order 2017-Revision; regarding.

Department for Promotion of Industry and Internal Trade, In partial modification [Paras 2, 3, 5, 10 & 13] of Order No.P-45021/2/2017-B.E.-II dated 15.6.2017 as amended by Order No.P-45021/2/2017-B.E.-II dated 28.05.2018, Order No.P-45021/2/2017-B.E.-II dated 29.05.2019, Order No.P-45021/2/2017-B.E.-II dated 04.06.2020 and Order No.P-45021/2/2017-B.E.-II dated 16.09.2020 hereby Issues the revised 'Public Procurement (Preference to Make in India), Order 2017' dated 19.07.2024 effective with immediate effect.

Whereas it is the policy of the Government of India to encourage 'Make in India' and promote manufacturing and production of goods and services in India with a view to enhancing income and employment, and

Whereas procurement by the Government is substantial in amount and can contribute towards this policy objective, and

Whereas local content can be increased through partnerships, cooperation with local companies, establishing production units in India or Joint Ventures (JV) with Indian suppliers, increasing the participation of local employees in services and training them,

Now therefore the following Order is issued:

1. This Order is issued pursuant to Rule 153 (iii) of the General Financial Rules 2017.
2. **Definitions:** For the purposes of this Order:
'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

Explanatory notes for calculation of local content given above

- a. Imported items sourced locally from resellers/distributors shall be excluded from calculation of local content.
- b. The license fees/royalties paid/ technical charges paid out of India shall be excluded from local content calculation.

- c. Procurement/Supply of repackaged/refurbished/rebranded imported products as understood commonly shall be treated as reselling of imported products and shall be excluded from calculation of local content. The definition of repackaged/refurbished/rebranded imported products is as follows;

'Refurbishing' means repair or reconditioning of an imported product does not amount to manufacture because no new goods come into existence.

'Repackaging' means repacking of imported goods from bulk pack to smaller packs would not ordinarily amount to manufacture of a new item.

'Rebranding' means relabeling or renaming or change in symbol or logo/makes or corporate image of a company/organization/ firm for an imported product would amount to rebranding.

- d. To ensure that imported items sourced locally from resellers/distributors are excluded from calculation of local content, procuring entities to obtain from bidders, the cost of such locally-sourced imported items (Inclusive of taxes) along with break-up on license/royalties paid/technical expertise cost etc. sourced from outside India. For items sold by bidder as reseller, OEM certificate for country of origin to be submitted.
- e. For contracts involving supply of multiple items, weighted average of all items to be taken while calculating the local content.

'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order.

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for 'Class-I local supplier' under this Order.

'Non - Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order.

'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

'Margin of purchase preference' means the maximum extent to which the price quoted by a "Class-I local supplier" may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

'Works' means all works as per Rule 130 of GFR- 2017, and will also include 'turnkey works'.

2A. Special treatment for items covered under PLI Scheme

The manufacturers manufacturing an item under PLI scheme shall be treated as deemed Class II local supplier for that item unless they have minimum local content equal to or higher than that notified for Class-I local supplier for that item, provided the manufacturer has received incentive from the concerned PLI Ministry for the item. The above shall be applicable for the specific time period only, as notified by concerned PLI Ministry.

3. Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement

(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurement undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by sub-para 3(a) above, and with estimated value of purchases less than Rs. 200 Crore, in accordance with Rule 161(iv) of GFR, 2017, Global tender enquiry shall not be issued except with the approval of competent authority as designated by Department of Expenditure.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

3.1 Mandatory sourcing of items, with sufficient local capacity and competition, from Class-I local suppliers in SI/EPC/Turnkey Contracts/Service Tenders

- a. The items, notified as having sufficient local capacity and competition, shall mandatory be sourced from Class-I local suppliers in SI/EPC/Turnkey Contracts/ Services tenders. This provision will be applicable only for those items which have been notified by the Nodal Ministry as Class I i.e. having sufficient local capacity and competition, with specific HSN codes."
- b. Notwithstanding above, if in any project, it is considered that it is not practically feasible to source such items from Class I local suppliers, it may take relaxation from such stipulation with the approval of Secretary of the administrative Ministry/ Department concerned or with the approval of the Competent Authority specified by the Administrative Ministry/Department, on case-specific basis.

3A. Purchase Preference

(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurement undertaken by procuring entities in the manner specified here under.

(b) In the procurement of goods or works, which are covered by para 3(b)

above and which are divisible in nature, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

- i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.
 - ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder.
- (c) In the procurement of goods or works, which are covered by para 3(b) above and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:
- i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is Class -I local supplier', the contract will be awarded to L1.
 - ii. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.
 - iii. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.
- (d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

3B. Applicability in tenders where contract is to be awarded to multiple bidders- In tenders where contract is awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

- a. In case there is sufficient local capacity and competition for the item to be procured, as notified by the nodal Ministry, only Class I local suppliers shall be eligible to bid. As such, the multiple suppliers, who would be awarded the contract, should be all and only 'Class I Local suppliers'.
- b. In other cases, 'Class II local suppliers' and 'Non local suppliers' may also participate in the bidding process along with 'Class I Local suppliers' as per provisions of this Order.
- c. If 'Class I Local suppliers' qualify for award of contract for at least

50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class I Local suppliers' do not qualify for award of contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class I local supplier' over 'Class II local suppliers'/ 'Non local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class I Local suppliers' taken in totality are considered for award of contract for at least 50% of the tendered quantity.

- d. First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference, subject to its meeting the prescribed criteria for award of contract as also the constraint of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier', falling within 20% margin of purchase preference, and so on.
 - e. To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulated in sub- paras above.
4. **Exemption of small purchases:** Notwithstanding anything contained in paragraph 3, procurement where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

4A. Exemption in sourcing of spares and consumables of closed systems:

Procurement of spare parts, consumables for closed systems and Maintenance/ Service contracts with Original Equipment Manufacturer/Original Equipment Supplier/Original Part Manufacturer shall be exempted from this Order.

5. **Minimum local content:** The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the 'local content' requirement is minimum 20%. Nodal Ministry/ Department may prescribe only a higher percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/ 'Class- II local supplier'. For the items, for which Nodal Ministry/ Department has not prescribed higher minimum local content notification under the Order, it shall be 50% and 20% for 'Class-I local supplier'/ 'Class-II local supplier' respectively.
6. **Margin of Purchase Preference:** The margin of purchase preference shall be 20%.
7. **Requirement for specification in advance:** The minimum local content, the margin of purchase preference and the procedure for preference to Make in India shall be specified in the notice inviting tenders or other form of procurement solicitation and shall not be varied during a particular procurement transaction.
8. **Government E-marketplace:** In respect of procurement through the Government E-marketplace (GeM) shall, as far as possible, specifically mark the items which meet the minimum local content while registering the item for

display, and shall, wherever feasible, make provision for automated comparison with purchase preference and without purchase preference and for obtaining consent of the local supplier in those cases where purchase preference is to be exercised.

9. Verification of local content:

- a. The 'Class-I local supplier'/ 'Class-II local supplier' at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for 'Class-I local supplier'/ 'Class-II local supplier', as the case may be. They shall also give details of the location(s) at which the local value addition is made.
- b. In cases of procurement for a value in excess of Rs. 10 crores, the 'Class-I local supplier'/ 'Class-II local supplier' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.
- c. The bidder shall give self-certification for local content in the quoted item (goods/works/services) at the time of tendering. However, at the time of execution of the project, for all contracts above INR 10 Crore, the contractor/ supplier shall be required to give local content certification duly certified by cost/ chartered accountant in practice. For cases where it is not possible to provide certification by Cost/Chartered Accountant at the time of execution of project, the supplier shall be permitted to provide the certificate for local content from Cost/ Chartered Accountant after completion of the contract, within time limit acceptable to the procuring entity. In case the contractor/ supplier does not meet the stipulated local content requirement and the category of the supplier changes from Class-I to Class-II/ Non-local or from Class-II to Non-local, a penalty upto 10% of the contract value may be imposed. However, contract once awarded shall not be terminated on this account.
- d. Decisions on complaints relating to implementation of this Order shall be taken by the competent authority which is empowered to look into procurement-related complaints relating to the procuring entity.
- e. Nodal Ministries may constitute committees with internal and external experts for independent verification of self-declarations and auditor's/ accountant's certificates on random basis and in the case of complaints.
- f. Nodal Ministries and procuring entities may prescribe fees for such complaints.
- g. False declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.
- h. A supplier who has been debarred by any procuring entity for violation of this Order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of the debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities, in the manner prescribed under paragraph 9

i below.

- i. The Department of Expenditure shall issue suitable instructions for the effective and smooth operation of this process, so that:
 - i. The fact and duration of debarment for violation of this Order by any procuring entity are promptly brought to the notice of the Member-Convenor of the Standing Committee and the Department of Expenditure through the concerned Ministry /Department or in some other manner;
 - ii. On a periodical basis such cases are consolidated and a centralized list or decentralized lists of such suppliers with the period of debarment is maintained and displayed on website(s);
 - iii. In respect of procuring entities other than the one which has carried out the debarment, the debarment takes effect prospectively from the date of uploading on the website(s) in the such a manner that ongoing procurement are not disrupted.

10. Specifications in Tenders and other procurement solicitations:

- a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.
- b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.
- c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.
- d. **Reciprocity Clause**
 - i. When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of barring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc., it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.
 - ii. Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all items related to that nodal Ministry/ Department, except for the list of items published by the Ministry/ Department permitting their participation.
 - iii. The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchases on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/ Department.
 - iv. State Governments should be encouraged to incorporate similar provisions in their respective tenders.
 - v. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.
- e. Specifying foreign certifications/ unreasonable technical specifications/



brands/ models in the bid document is restrictive and discriminatory practice against local suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/or for any other reason, the same shall be done only after written approval of Secretary of the Department concerned or any other Authority having been designated such power by the Secretary of the Department concerned.

- f. "All administrative Ministries/Departments whose procurement exceeds Rs. 1000 Crore per annum shall notify/update their procurement projections every year, including those of the PSEs/PSUs, for the next 5 years on their respective website."

10A. Action for non-compliance of the Provisions of the Order: In case restrictive or discriminatory conditions against domestic suppliers are included in bid documents, an inquiry shall be conducted by the Administrative Department undertaking the procurement (including procurement by any entity under its administrative control) to fix responsibility for the same. Thereafter, appropriate action, administrative or otherwise, shall be taken against erring officials of procurement entities under relevant provisions. Intimation on all such actions shall be sent to the Standing Committee.

11. **Assessment of supply base by Nodal Ministries:** The Nodal Ministry shall keep in view the domestic manufacturing / supply base and assess the available capacity and the extent of local competition while identifying items and prescribing the higher minimum local content or the manner of its calculation, with a view to avoiding cost increase from the operation of this Order.
12. **Increase in minimum local content:** The Nodal Ministry may annually review the local content requirements with a view to increasing them, subject to availability of sufficient local competition with adequate quality.
13. **Manufacture under license/ technology collaboration agreements with phased indigenization:** While notifying the minimum local content, Nodal Ministries may make special provisions for exempting suppliers from meeting the stipulated local content if the product is being manufactured in India under a license from a foreign manufacturer who holds intellectual property rights and where there is a technology collaboration agreement / transfer of technology agreement for indigenous manufacture of a product developed abroad with clear phasing of increase in local content.

13A. In procurement of all goods, services or works in respect of which there is substantial quantity of public procurement and for which the nodal ministry has not notified that there is sufficient local capacity and local competition, the concerned nodal ministry shall notify an upper threshold value of procurement beyond which foreign companies shall enter into a joint venture with an Indian company to participate in the tender. Procuring entities, while procuring such items beyond the notified threshold value, shall prescribe in their respective tenders that foreign companies may enter into a joint venture with an Indian company to participate in the tender. The procuring Ministries/Departments shall also make special provisions for exempting such joint ventures from meeting the stipulated minimum local content requirement, which shall be increased in a phased manner.

14. **Powers to grant exemption and to reduce minimum local content:** The administrative Department undertaking the procurement (including

procurement by any entity under its administrative control), with the approval of their Minister-in-charge, may by written order, for reasons to be recorded in writing,

- a. reduce the minimum local content below the prescribed level; or
- b. reduce the margin of purchase preference below 20%; or
- c. exempt any particular item or supplying entities from the operation of this Order or any part of the Order.

The Administrative Department, while seeking exemption under this para, shall certify that such an item(s) has not been notified by Nodal Ministry/ Department concerned under para 3 (a) of the Order.

A copy of every such order shall be provided to the Standing Committee and concerned Nodal Ministry / Department. The Nodal Ministry / Department concerned will continue to have the power to vary its notification on Minimum Local Content.

15. **Directions to Government companies:** In respect of Government companies and other procuring entities not governed by the General Financial Rules, the administrative Ministry or Department shall issue policy directions requiring compliance with this Order.
16. **Standing Committee:** A standing committee is hereby constituted with the following membership:
 Secretary, Department for Promotion of Industry and Internal Trade - Chairman
 Secretary, Commerce—Member
 Secretary, Ministry of Electronics and Information Technology—Member Joint
 Secretary (Public Procurement), Department of Expenditure—Member Joint
 Secretary (DPIIT)—Member-Convenor

The Secretary of the Department concerned with a particular item shall be a member in respect of issues relating to such item. The Chairman of the Committee may co-opt technical experts as relevant to any issue or class of issues under its consideration.

17. **Functions of the Standing Committee:** The Standing Committee shall meet as often as necessary, but not less than once in six months. The Committee
 - a. shall oversee the implementation of this order and issues arising therefrom, and make recommendations to Nodal Ministries and procuring entities.
 - b. shall annually assess and periodically monitor compliance with this Order
 - c. shall identify Nodal Ministries and the allocation of items among them for issue of notifications on minimum local content
 - d. may require furnishing of details or returns regarding compliance with this Order and related matters
 - e. may, during the annual review or otherwise, assess issues, if any, where it is felt that the manner of implementation of the order results in any restrictive practices, cartelization or increase in public expenditure and suggest remedial measures
 - f. may examine cases covered by paragraph 13 above relating to manufacture under license/ technology transfer agreements with a view to satisfying itself that adequate mechanisms exist for enforcement of such agreements and for attaining the underlying objective of progressive indigenization

- g. may consider any other issue relating to this Order which may arise.
18. **Removal of difficulties:** Ministries /Departments and the Boards of Directors of Government companies may issue such clarifications and instructions as may be necessary for the removal of any difficulties arising in the implementation of this Order.
19. **Ministries having existing policies:** Where any Ministry or Department has its own policy for preference to local content approved by the Cabinet after 1st January 2015, such policies will prevail over the provisions of this Order. All other existing orders on preference to local content shall be reviewed by the Nodal Ministries and revised as needed to conform to this Order, within two months of the issue of this Order.
20. **Transitional provision:** This Order shall not apply to any tender or procurement for which notice inviting tender or other form of procurement solicitation has been issued before the issue of this Order.



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PART-A
VOLUME – VII
ERECTION CONDITIONS OF CONTRACT

ERECTION CONDITIONS OF CONTRACT

1.00.00 GENERAL

1.01.00 The following provisions shall supplement the conditions already contained in the other parts of these specifications and documents and shall govern that portion of the work of this contract which is to be performed at site. The erection requirements and procedures not specified in these documents shall be in accordance with the recommendations of the equipment manufacturer, or as mutually agreed to between the Employer and the Contractor prior to commencement of erection work.

1.02.00 The Contractor upon signing of the Contract shall in addition to a Project Co-ordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and co-ordination of the Works to be performed at Site. Such a person shall function from the Site office of the Contractor during the pendency of Contract.

2.00.00 REGULATION OF LOCAL AUTHORITIES AND STATUTES

2.01.00 In addition to the local laws and regulations, the Contractor shall also comply with the Minimum Wages Act and the Payment of Wages Act (both of the Government of India) and the rules made there under in respect of its labour and the labour of its sub-contractors currently employed on or connected with the contract.

2.02.00 All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully pay-able under the provisions of the Indian Boiler Regulations and any other statutory laws and its amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the Employer, shall be to the account of the Employer. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor or his Sub-Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor.

3.00.00 WELDING REQUIREMENTS (AS APPLICABLE)

The welding of all pressure parts and high pressure piping shall be in accordance with the following requirements:

3.01.00 Qualification of Weld Procedures

Only qualified welding procedures as per ASME Section IX shall be used by contractor at site. Procedure qualification records along with WPS shall be submitted to NVVN for review. Welding procedure shall indicate all essential and non-essential parameters as per ASME Section IX. Makes of welding consumables shall be subject to employer's approval.

3.02.00 Welder's Qualification

Only welders who are qualified in accordance with the latest applicable requirements of the Indian Boiler Regulations, shall be permitted to perform any welding work on the pressure parts and its attachment welding. In addition to such statutory qualification requirements, the welders shall also undergo a satisfactory pre-production qualification test to be conducted by the Contractor at site as per ASME Sec IX in presence of employer's representative(s), prior to performing work under these specifications. The services of an independent testing laboratory shall be retained by the Contractor to perform welder qualification tests for welders.

All the welders carrying out welding at site shall carry an identification badge, which shall indicate the category and the grade of welding for which they have been tested and authorised to carry out welding.

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3.03.00 Records

Welders performance shall be monitored regularly and record of their performance shall be maintained by contractor in a manner acceptable to the employer. Contractor shall maintain such records including record of procedure qualification & welder qualification and hand-over to the employer at the end of work.

3.04.00 MARKING

On completion of each welded joint, the welder shall mark his regularly assigned identification mark near the joint. The welder's identification numbers, inspection stamps or code symbol stamps and any other information shall not be directly stamped on any alloy steel piping. In alloy steel piping, all such information shall be stamped on separate marking plate which shall be tack welded on pipe near the weld.

4.00.00 HEAT TREATMENT

4.01.00 Pre-heating, post-heating and post-weld stress relief operations of all welds, shall be performed in accordance with the requirements of applicable code. Local post weld stress relieving heat treatments shall be adopted only in cases where it is normally impracticable to subject the entire assembly as such for stress relieving operations. Heating may be by means of electric induction coils or electric resistance coils. Oxy-acetylene flame heating or exothermic chemical heating methods will not be permitted. Complete recording of the temperatures through out the stress relieving cycle of the material and the weld subjected to heat treatment shall be made by means of a potentiometric recorder. Recorders other than those of potentiometric type shall not be used for such temperature recording during stress relieving operations.

The contractor & employer's representative, at start and at the end of HT Cycle shall sign the time and temperature charts for heat-treatment.

4.03.00 After setting up the weld joint for heat treatment operation, the Employer's signature shall be obtained on the strips chart of the recorder prior to starting of heat treatment cycle. The right hand corner of the strip chart at the starting point of the heat treatment cycle shall contain details like the weld number, material, diameter and thickness, method of heating adopted, prescribed ranges of heat treatment temperatures, date of heat treatment, reference to item number of the Field welding Schedule (as specified at clause no 7.00.00- of this chapter) etc.

5.00.00 WELD EDGE PREPARATION

Preparation at site of weld joint shall be in accordance with details acceptable to the Employer. Wherever possible, machining or automatic flame cutting shall be used for edge preparation. Hand flame cutting will be permitted only where edge preparation otherwise is impractical. All slag shall be removed from cuts and all the hand cuts shall be ground smooth to the satisfaction of the Employer. Flame cutting of alloy steel pipe shall be avoided. Wherever such cutting is done, a 200mm length at the cut face shall be removed by machining. Pneumatic hand tools such as edge preparation, tube cutting machine can be used.

6.00.00 CLEANING AND SERVICING

6.01.00 The inside of all tubes, pipes, valves and fittings shall be free from dirt, and loose scales before being erected. All the pipelines shall be thoroughly blown and/or flushed. A system for recording of all such operations shall be developed and maintained in a manner to ensure that no obstructions are left inside the tubes and no tubes are left uncleaned and untested.

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6.02.00 All valves and valve actuators, and dampers and damper actuators, if any, shall be thoroughly cleaned and serviced prior to pre-commissioning tests and/or Initial Operations of the plant. A system for recording of such servicing operation shall be developed and maintained in a manner acceptable to the Employer and to ensure that no valves or dampers including their actuators are left unserviced.

6.03.00 All interior surfaces of the turbine shall be thoroughly cleaned prior to boxing - up to remove all traces of oil preservations.

7.00.00 FIELD WELDING SCHEDULE

The Contractor shall submit to the Employer, a certified and complete field welding schedule for all the field welding activities to be carried out in respect of the pressure parts involved in the equipment furnished and erected by him, at least 90 days prior to the scheduled start of erection work at site. Such schedule will be strictly followed by the Contractor during the process of erection. The above field-welding schedule to be issued by the Contractor shall contain the following:

- (a.) Drawing No (s)
- (b.) Location of the weld
- (c.) Size of the weld (outside diameter and thickness)
- (d.) Type of joints
- (e.) Material specifications
- (f.) Size of fillet on backing ring, when the type of joint is with backing ring
- (g.) Electrode/ filler metal specifications
- (h.) Number of welds per unit
- (i.) Quantity of filler metal per weld
- (j.) Indication of required Non-destructive Examination (NDE) for each weld
- (k.) Pre-heat temperatures for welding
- (l.) Process of welding
- (m.) Post-welding heat treatment temperature ranges, duration, under as specified at clause no 4.00.00 of this chapter entitled "Heat Treatment".
- (n.) Qualification details of weld procedures to be adopted as specified at clause no 3.01.00 of this chapter entitled 'Qualification of Weld Procedures'.

8.00.00 SITE RUN MISCELLANEOUS PIPING

Sketches or diagrams of the proposed routings of all piping, not already indicated and routed on the shop drawings which were reviewed by the Employer, shall be submitted to the Employer for review, Employer's acceptance of such site routings shall be obtained before the piping is erected. All these site run piping shall be installed in such a manner as to present an orderly and neat installation. They shall be located as to avoid obstruction of access and passages. Valves, instruments or any other special items shall be located convenient for operation by the operating personnel. Pipe runs shall be plumb or level except

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where pitch for drainage is required. Pipe runs that are not parallel to the building structure, walls or column rows shall be avoided so that deflection of pipes between hangers does not exceed 6 mm. No miscellaneous pipe shall be routed and installed above or adjacent to electrical equipment.

9.00.00 THERMAL EXPANSIONS

All piping installation shall be such that no excessive or destructive expansion forces exist either in the cold condition or under condition of maximum temperature. All bends, expansion joints and any other special fittings, necessary to provide proper expansion, shall be incorporated. During installation of expansion joints and anchors, care must be taken to make sure that full design movement is available at all times for maximum to minimum temperature and vice-versa.

10.00.00 PIPING SUPPORTS

10.01.00 Hangers, supports and anchors shall be installed as required to obtain a safe, reliable and complete pipe installation. All supports shall be properly levelled and anchored when installed. The anchors shall be so placed that thermal expansion will be absorbed by bends without subjecting the valves or equipment to excessive strains.

10.02.00 The hanger assemblies shall not be used for the attachment of rigging to hoist the pipe into place. Other means shall be used to securely hold the pipe in place till the pipe support is completely assembled and attached to the pipe and building structures and spring support is set to accommodate the pipe way. All temporary rigging shall be removed in such a way that the pipe support is not subjected to any sudden load. All piping, having variable spring type supports, shall be held securely in place by temporary means during the hydraulic test of pipe system. Constant support type spring hangers used during hydraulic test shall be pinned or blocked solid during the test. After complete installation and insulation of the piping and filling of the piping with its normal operating medium, the pipe support springs shall be adjusted to the cold positions. If necessary, the spring support shall be re-adjusted to the hot positions after the line has been placed for service at its normal maximum operating temperature conditions. Electric arc welding only shall be used to weld all pipe supports to structural steel members that form part of the building supporting structure. The structural beams shall not be heated more than necessary during welding of supports and such welds shall run parallel to the axis of the span. All lugs or any other attachments welded to the piping shall be of the same material as the pipe.

11.00.00 PRESSURE TESTING

11.01.00 On completion of erection, Contractor is required to carry out hydraulic test to fulfill with the Statutory requirements. It is contractor responsibility to identify & fulfill all the statutory requirements.

11.02.00 All blank flanges or any removable plugs required for openings not closed by the valves, and piping provided, shall be furnished by the Contractor. The pressurization equipment including water piping from the supply, needed for the above test shall also be furnished by the Contractor. Any defects noticed during the testing are to be rectified and the unit re-tested. If any welding is done on the pressure parts after the Hydraulic test, the Hydraulic test for that portion of pressure parts shall be repeated.

12.00.00 THERMOWELLS AND FLOW NOZZLES

12.01.00 All the thermowells and flow nozzles in the equipment furnished under the technical specifications shall be installed as a part of this work.

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13.00.00 INSULATION, LAGGING AND CLADDING

The provision of insulation, lagging and cladding of the various equipments and portion of the equipment covered under the Contract, shall be furnished by the Contractor as specified elsewhere or agree to separately in writing. Welds required for holding insulation on pressure parts shall be carried out by IBR qualified welder.

13.01.00 Piping, Pipe Fittings & Valves

All piping insulation and metal cladding furnished with the equipment to be erected shall be applied as specified herein.

13.01.01 Piping

The insulation on piping shall be applied using wire loops on 150mm centres. These wire loops shall be thoroughly embedded into the outer insulation surface and all cracks, voids and depressions shall be filled with insulating cement suitable for the piping temperature so as to form a smooth base for application of cladding. The wires used for piping insulation shall be of 16 SWG. The surface shall be smooth and uniform before applying the outer covering. All piping insulation ends shall be terminated at a sufficient distance from flanges to facilitate removal of bolts.

13.01.02 Flanges

Insulation on flanges shall be by means of blocks of insulating material securely bound to the flange by wire loops. Such blocks of insulation shall be long enough to overlap the adjacent pipe insulation by an amount equal to the thickness of adjacent pipe insulation. Smooth finish shall be obtained by the application of insulating cement. Alternatively, sectional pipe insulation of proper diameter may be used. Insulation on flanges shall not be done until the pipe and equipment have been in service during the initial operation and till all the flange bolts have been retightened.

13.01.03 Bends and Elbows

Insulation on bends and elbows shall be cut into sections sufficiently short to form a reasonable smooth external surface. After the application of insulation material in place, it shall be smoothly coated with insulating cement. Elbows may be insulated as above or alternatively by means of specially moulded insulation enclosures.

13.01.04 Cladding

Cladding shall be of aluminium sheet of thickness as per details given in detail Technical Specification or will be provided during detail engineering shall be machine rolled and formed to accurately fit insulation curvatures. Cladding shall be secured using self-tapping screws. Screws shall be adequate number and so located as to produce tight joints. The spacing of screws shall be as far as possible uniform and on centres not exceeding 150 mm. For outside diameters less than 230 mm, spacing of screws shall be on centres not exceeding 100 mm. adequate number of screws shall be provided for fixing the cladding and be so placed in such locations, as to produce a smooth cladding finish without bellying. Insulated elbows having insulated diameters less than 330 mm shall be provided with preformed smooth aluminium elbow jackets. Wherever possible, all joints should be lapped a minimum of 50 mm with joints facing downwards and so placed that they are obscured from normal points of vision. All the joints in the cladding shall be made with suitable provisions for expansions. All butt joints such as those at piping tees shall be made using rolled seams. In addition, to prevent galvanic corrosion, suitable action/procedure to be implemented.

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13.01.05 Valves and Fittings

All valves and fittings (above valve size of 2 inches) installed in the pipelines shall also be applied with insulation and furnished with suitably shaped boxes so as to facilitate easy dismantling of the fittings. The insulation thickness for valves, valve fittings etc., shall be same as that used on the line on which they are installed. All voids shall be properly filled up with insulating material and as per the directions of the Employer.

13.02.00 Protection of Equipment during Insulation Applications

All equipment and structures shall be suitably protected from damage while applying insulation after completion of insulation. All equipment and structures shall be thoroughly cleaned and remove insulating materials which might have fallen on them.

14.00.00 CODE REQUIREMENTS

The erection requirements and procedures to be followed during the installation of the equipment shall be in accordance with the relevant Indian Electricity Rules & Codes, ASME codes and accepted good practices, the Employer's Drawings and other applicable Indian recognised codes and laws and regulations of the Government of India.

15.00.00 ELECTRICAL SAFETY REGULATIONS

15.01.00 In no circumstances will the Contractor interfere with fuses and electrical equipment belonging to the other Contractor or Employer.

15.02.00 Before the Contractor connects any electrical appliances to any plug or socket belonging to the other Contractor or Employer, he shall:

- (a) Satisfy the Employer that the appliance is in good working condition.
- (b) Inform the Employer of the maximum current rating, voltage and phase of the appliances.
- (c) Obtain permission of the Employer detailing the socket to which the appliances may be connected.

The Employer will not grant permission to connect until he is satisfied that

- (d) The appliance is in good condition and is fitted with suitable plug.
- (e) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

15.03.00 No electric cable in use by the other Contractor/Employer will be disturbed without permission. No weight of any description will be imposed on any such cable and ladder or similar equipment will rest against or to be attached with it.

15.04.00 No repair work shall be carried out on any live equipment. The equipment must be declared safe by the Employer and a permit to work issued before any work is carried out.

15.05.00 The Contractor shall employ the necessary number of qualified full time electricians to maintain his temporary electrical installation.

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16.00.00 REMOVAL OF MATERIAL

No material brought to the Site shall be removed from the Site by the Contractor and/or his Sub-Contractors without the prior written approval of the Employer.

17.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

The provisions of the clause entitled Inspection, Testing and Inspection Certificates given in Part - C of the Technical Specification, shall also be applicable to the erection portion of the Works. The Employer shall have the right to re-inspect any equipment though previously inspected and approved by him at the Contractor's works, before and after the same are erected at Site. If by the above inspection, the Employer rejects any equipment, the Contractor shall make good for such rejections either by replacement or modification/ repairs as may be necessary to the satisfaction of the Employer. Such replacements will also include the replacements or re-execution of such of those works of other Contractors and/or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor's work.

18.00.00 ACCESS TO SITE AND WORKS ON SITE

18.01.00 Suitable access to site and permission to work at the Site shall be accorded to the Contractor by the Employer in reasonable time.

18.02.00 In the execution of the Works, no person other than the Contractor or his duly appointed representative, Sub-Contractor and workmen, shall be allowed to do work on the Site, except by the special permission, in writing by the Employer or his representative.

19.00.00 CONTRACTOR'S SITE OFFICE ESTABLISHMENT

The Contractor shall establish an Office at the Site and keep posted an authorised representative for the purpose of the Contract. Any written order or instruction of the Employer or his duly authorised representative, shall be communicated to the said authorised resident representative of the Contractor and the same shall be deemed to have been communicated to the Contractor at his legal address.

20.00.00 CO-OPERATION WITH OTHER CONTRACTORS

20.01.00 Employer, who may be performing other works on behalf of the Employer and the workmen who may be employed by the Employer and doing work in the vicinity of the works under the Contract. The Contractor shall also arrange to perform his work as to minimise, to the maximum extent possible, interference with the work of other Contracts and their workmen. Any injury or damage that may be sustained by the employees of the other Contractors and the Employer, due to the Contractor's work shall promptly be made good at his own expense. The Employer shall determine the resolution of any difference or conflict that may arise between the Contractor and other Contractors or between the Contractor and the workmen of the Employer in regard to their work. If the work of the Contractor is delayed because of the any acts of omission of another Contractor, the Contractor shall have no claim against the Employer on that account other than an extension of time for completing his works. Employer shall have full access to visit the contractor's site at any time for inspection and surveillance checks.

20.02.00 The Employer/Client shall be notified promptly by the Contractor of any defects in the other Contractor's works that could affect the Contractor's Works. The Employer shall determine the corrective measures if any, required to rectify this situation after inspection of the works and such decisions by the Employer shall be binding on the Contractor.

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21.00.00 DISCIPLINE OF WORKMEN

The Contractor shall adhere to the disciplinary procedure set by the Employer in respect of his employees and workmen at Site. The Employer shall be at liberty to object to the presence of any representative or employee of the Contractor at the Site, if in the opinion of the Employer such employee has misconducted himself or is incompetent, negligent or otherwise undesirable then the Contractor shall remove such a person objected to and provide in his place a competent replacement.

22.00.00 CONTRACTOR'S FIELD OPERATION

22.01.00 The Contractor shall keep the Employer informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the Employer shall not relieve the Contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Employer or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.

22.02.00 The Contractor shall have the complete responsibility for the conditions of the Work-Site including the safety of all persons employed by him or his Sub-Contractor and all the properties under his custody during the performance of the work. This requirement shall apply continuously till the completion of the Contract and shall not be limited to normal working hours. The construction review by the Employer is not intended to include review of Contractor's safety measures in, on or near the Work-Site, and their adequacy or otherwise.

23.00.00 PHOTOGRAPHS AND PROGRESS REPORT

23.01.00 The Contractor shall furnish three (3) prints each to the Employer of progress photographs of the work done at Site. Photographs shall be taken as and when indicated by the Employer or his representative. Photographs shall be adequate in size and number to indicate various stages of erection. Each photograph shall contain the date, the name of the Contractor and the title of the photograph.

23.02.00 The above photographs shall accompany the monthly progress report detailing out the progress achieved on all erection activities as compared to the schedules. The report shall also indicate the reasons for the variance between the scheduled and actual progress and the action proposed for corrective measures, wherever necessary.

23.03.00 The Contractor shall submit the progress of work in CD/DVD (2 copies) quarterly highlighting the progress and constraints at site.

24.00.00 MAN-POWER REPORT

24.01.00 The Contractor shall submit to the Employer, on the first day of every month, a man hour schedule for the month, detailing the man hours scheduled for the month, skill-wise and area-wise.

24.02.00 The Contractor shall also submit to the Employer on the first day of every month, a man power report of the previous month detailing the number of persons scheduled to have been employed and actually employed, skill- wise and the areas of employment of such labour.

25.00.00 PROTECTION OF WORK

The Contractor shall have total responsibility for protecting his works till it is finally taken over by the Employer. No claim will be entertained by the Employer or the representative of the

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Employer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings. Should any such damage to the Contractor's Works occur because of other party not being under his supervision or control, the Contractor shall make his claim directly with the party concerned. If disagreement or conflict or dispute develops between the Contractor and the other party or parties concerned regarding the responsibility for damage to the Contractor's Works the same shall be resolved as per the provisions of the as specified at clause no 20.00.00- of this chapter entitled "Co-operation with other Contractors." The Contractor shall not cause any delay in the repair of such damaged Works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.

26.00.00 EMPLOYMENT OF LABOUR

26.01.00 In addition to all local laws and regulations pertaining to the employment of labour to be complied with by the Contractor pursuant to GCC, the Contractor will be expected to employ on the work only his regular skilled employees with experience of the particular work. No female labour shall be employed after darkness. No person below the age of eighteen years shall be employed.

26.02.00 All travelling expenses including provisions of all necessary transport to and from Site, lodging allowances and other payments to the Contractor's employees shall be the sole responsibility of the Contractor.

26.03.00 The hours of work on the Site shall be decided by the Employer and the Contractor shall adhere to it. Working hours will normally be eight (8) hours per day - Monday through Saturday.

26.04.00 Contractor's employees shall wear identification badges while on work at Site.

26.05.00 In case the Employer becomes liable to pay any wages or dues to the labour or any Government agency under any of the provisions of the Minimum Wages Act, Workmen Compensation Act, Contract Labour Regulation Abolition Act or any other law due to act of omission of the Contractor, the Employer may make such payments and shall recover the same from the Contractor's Bills.

27.00.00 NOT USED

28.00.00 FACILITIES TO BE PROVIDED BY THE CONTRACTOR

28.01.00 Contractor's site office Establishment

The Contractor shall establish a site office at the site and keep posted an authorized representative for the purpose of the contract, pursuant to GCC.

28.02.00 Tools, tackles and scaffoldings

The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, installation, testing, commissioning and conducting Guarantee tests of the equipments covered under the Contract. He shall submit a list of all such materials to the Employer before the commencement of pre-assembly at Site. These tools and tackles shall not be removed from the Site without the written permission of the Employer. The Contractor shall arrange Dozer, Hydra, Cranes, Trailer, etc. for the purpose of fabrication, erection and commissioning.

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28.03.00 **Testing Equipment and Facilities:**

The contractor shall provide the necessary testing, equipment and facilities.

28.04.00 **Site laboratory for civil works:**

Contractor shall provide and maintain a site laboratory for the testing of construction material under the direction and general supervision of employer.

28.05.00 **First-Aid**

28.05.01 The Contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site. Enough number of Contractor's personnel shall be trained in administering first-aid.

28.05.02 The Employer will provide the Contractor, in case of any emergency, the services of an ambulance for transportation to the nearest hospital.

28.06.00 **Cleanliness**

28.06.01 The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of Contract. The Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed in a place to be identified by the Employer. Materials and stores shall be so arranged to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.

28.06.02 Similarly the labour colony, the offices and the residential areas of the Contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of the Employer. Proper sanitary arrangements shall be provided by the Contractor, in the work-areas, office and residential areas of the Contractor.

28.07.00 The Contractor shall provide one (1) no. multi-utility vehicle (min. 6 seater) for facilitating movement of Employer's official of the Project, within as well as outside the plant premises. All expenses towards operation and maintenance including provision of drivers, fuel etc. associated with the vehicles shall be borne by the bidder from the date of site office opening till the completion of trial operation of the last unit.

28.08.00 **Electricity**

Refer to construction power, as envisaged in volume-III, Part A, Sec VI of Technical specification.

28.09.00 **Water**

Contractor shall make all arrangements himself for the supply of construction water as well as potable water for labour and other personnel at the worksite/colony. However, drawl of construction/potable water from bore-well shall be permitted if found suitable. Any statutory clearance required shall be obtained by the contractor. Assistance, if required shall be provided by the owner.

29.00.00 **LINES AND GRADES**

All the Works shall be performed to the lines, grades and elevations indicated on the drawings. The Contractor shall be responsible to locate and layout the Works. Basic horizontal and vertical control points will be established and marked by the Employer at Site at suitable points. These points shall be used as datum for the works under the Contract.

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The Contractor shall inform the Employer well in advance of the times and places at which he wishes to do work in the area allotted to him so that suitable datum points may be established and checked by the Employer to enable the Contractor to proceed with his works. Any work done without being properly located may be removed and/or dismantled by the Employer at Contractor's expense.

30.00.00 FIRE PROTECTION

30.01.00 The work procedures that are to be used during the erection shall be those which minimise fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the Site at least once each day. Fuels, oils and volatile or flammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Untreated canvas, paper, plastic or other flammable flexible materials shall not at all be used at Site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the Site, the same shall be removed and replaced with acceptable material before moving into the construction or storage area.

30.02.00 Similarly corrugated paper fabricated cartons etc. will not be permitted in the construction area either for storage or for handling of materials. All such materials used shall be of water proof and flame resistant type. All the other materials such as working drawings, plans etc. which are combustible but are essential for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.

30.03.00 All the Contractor's supervisory personnel and sufficient number of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the Contract.

30.04.00 The Contractor shall provide enough fire protection equipment of the types and number for the warehouses, office, temporary structures, labour colony area etc. Access to such fire protection equipment, shall be easy and kept open at all time.

31.00.00 SECURITY

The Contractor shall have total responsibility for all equipment and materials in his custody stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss. All materials of the Contractor shall enter and leave the Employer Site only with the written permission of the Employer in the prescribed manner.

32.00.00 CONTRACTOR'S AREA LIMITS

The Employer will mark-out the boundary limits of access roads, parking spaces, storage and construction areas for the Contractor and the Contractor shall not trespass the areas not so marked out for him. The Contractor shall be responsible to ensure that none of his personnel move out of the areas marked out for his operations. In case of such a need for the Contractor's personnel to work out of the areas marked out for him the same shall be done only with the written permission of the Employer.

33.00.00 CONTRACTOR'S CO-OPERATION WITH THE EMPLOYER

In case where the performance of the erection work by the Contractor affects the operation of the system facilities of the Employer, such erection work of the Contractor shall be scheduled to be performed only in the manner stipulated by the Employer and the same shall be acceptable at all times to the Contractor. The Employer may impose such restrictions on

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the facilities provided to the Contractor such as electricity, etc. as he may think fit in the interest of the Employer and the Contractor shall strictly adhere to such restrictions and co-operate with the Employer. It will be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems which are erected by him. The Contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment furnished and installed by him, so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in documents and specifications.

34.00.00 PRE-COMMISSIONING AND COMMISSIONING ACTIVITIES

34.01.00 GENERAL

34.01.01 The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the equipment/systems ready for safe, reliable and efficient operation on sustained basis. All pre-commissioning/commissioning activities considered essential for such readiness of the equipment/systems including those mutually agreed and included in the Contractor's quality assurance programme as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the contractor.

34.01.02 The pre-commissioning and commissioning activities including Guarantee/demonstration/acceptability tests, checks and trial operations of the equipment/ systems furnished and installed by the contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at site during such operations.

34.01.03 The following activities shall be carried out by the contractor, at least eight (8) month prior to schedule date of synchronization of 1st Genset.

- (a.) The contractor shall furnish the organization chart of his operation and commissioning engineers for the acceptance of employer. Adequate number of operation and commissioning engineers shall be deployed by the contractor to effectively meet the requirement of round the clock operation in shifts also, till the plant is taken over by the employer.
- (b.) The contractor shall submit the bio-data containing the details of experience of his operation and commissioning engineers for the acceptance of employer.
- (c.) The contractor shall furnish the deployment schedule of his operation and commissioning engineers for the acceptance of the employer.
- (d.) Apart from above, contractor shall ensure deployment of sufficient skilled/semi-skilled/unskilled manpower during pre-commissioning and commissioning activities.

34.01.04 It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment/systems which are installed by him.

34.01.05 The Contractor shall also be responsible for flushing and initial filling of all oils and lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications and documents.

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34.02.00 COMMISSIONING DOCUMENTATION

- 34.02.01 The contractor shall submit the commissioning documentation, comprising of Standard checklists, pre-commissioning procedures, testing schedules, commissioning schedules and commissioning networks for various equipment/ systems covered under the contract, for the approval of employer.
- 34.02.02 Standard checklist, as the name suggests, shall be a fairly general documents, containing the list of all checks required to be carried out for similar and repetitive type of equipment to ensure consistent and thorough checking. An indicative list of such equipment is enclosed as Annexure I.
- 34.02.03 The testing schedule is a document, designed for safe and systematic commissioning of individual equipment/sub-system (for example Boiler Feed Pump, condensate pump, compressor etc) Commissioning schedule is a document envisaged for commissioning of a system (for example feed system, Condensate system, Compressed Air system, Fire water system, Unit commissioning etc). The testing/Commissioning schedule shall have a standard format in order to maintain consistency of presentation, content and reporting. A brief write up on the contents of the Testing Schedule/Commissioning Schedule is enclosed as Annexure-II.
- 34.02.04 The contractor shall submit the list of commissioning documentation to be submitted by him, alongwith their submission schedule for various equipment/systems covered under the contract, with in 6 (six) month from the date of award of contract, for the acceptance of employer.
- 34.02.05 The Contractor shall submit the commissioning documentation, for various equipment/covered under the contract, for the approval of employer, at least nine (9) months before the scheduled date of commissioning of the equipment/systems.

34.03.00 COMMISSIONING ACTIVITIES

- 34.03.01 Upon completion of pre-commissioning activities/tests, the contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carry out system checking and reliability trials on various parts of the facilities.
- 34.03.02 Contractor shall carry out the checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified.
- 34.03.03 Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence.
- 34.03.04 The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment of prior to that as the case may be.
- 34.03.05 Other tests shall be conducted, if required by the Employer, to establish that the plant equipment are in accordance with requirements of the specifications.
- 34.03.06 The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all electrical and C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied and installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications.

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34.05.00 **Initial Operation**

Upon completion of system checking/Tests as above and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation as stipulated in General Technical Requirements.

35.00.00 **MATERIALS HANDLING AND STORAGE**

35.01.00 All the equipments furnished under the Contract and arriving at Site shall be promptly received, unloaded and transported and stored in the storage spaces by the Contractor.

35.02.00 Contractor shall be responsible for examining all the shipment and notify the Employer immediately of any damage, shortage, discrepancy etc. for the purpose of Employer's information only. The Contractor shall submit to the Employer every week a report detailing all the receipts during the week. However, the Contractor shall be solely responsible for any shortages or damage in transit, handling and / or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

35.03.00 The Contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the Employer.

35.04.00 All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc. shall be used for unloading and/or handling of the equipment without the specific written permission of the Employer. The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at Site.

35.05.00 All electrical panels, controls gear, motors and such other devices shall be properly dried by heating before they are installed and energised. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.

35.06.00 All the electrical equipment such as motors, generators/alternators, etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values maintained by the Contractor. Such records shall be open for inspection by the Employer.

35.07.00 The Contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before the equipment are installed.

35.08.00 The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.

35.09.00 All the materials stored in the open or dusty location must be covered with suitable weatherproof and flame-proof covering material wherever applicable.

35.10.00 If the materials belonging to the Contractor are stored in areas other than those earmarked for him, the Employer will have the right to get it moved to the area earmarked for the Contractor at the Contractor's cost.

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35.11.00 The Contractor shall be responsible for making suitable indoor storage facilities to store all equipment which require indoor storage. Normally, all the electrical equipments such as motors, control gear, generators, exciters and consumables like electrodes, lubricants etc. shall be stored in the closed storage space. The Employer, in addition, may direct the Contractor to move certain other materials, which in his opinion will require indoor storage, to indoor storage areas which the Contractor shall strictly comply with.

36.00.00 CONSTRUCTION MANAGEMENT

36.01.00 The field activities of the Contractors working at Site, will be coordinated by the Employer and the Employer decision shall be final in resolving any disputes or conflicts between the Contractor and other Contractors and tradesmen of the Employer regarding scheduling and co-ordination of work. Such decision by the Employer shall not be a cause for extra compensation or extension of time for the Contractor.

36.02.00 The Employer shall hold weekly meetings of all the Contractors working at Site, at a time and place to be designated by the Employer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Employer and shall strictly adhere to those decisions in performing his Works. In addition to the above weekly meeting, the Employer may call for other meeting either with individual Contractors or with selected number of Contractors and in such a case the Contractor if called, will also attend such meetings.

36.03.00 Time is the essence of the Contract and the Contractor shall be responsible for performance of his works in accordance with the specified construction schedule. If at any time, the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such actions in writing to the Employer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

36.04.00 The Employer shall however not be responsible for provision of additional labour and/or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

36.05.00 Site management during construction phase till handing over of plant

Bidder shall ensure that the plant site within the plant boundary is managed in a coordinated and professional way all through the construction phase till handing over of plant, ensuring safe, easy & unhindered working conditions and a healthy & hygienic working environment at site. He shall ensure the following measures at site while executing the project.

- a) Bidder shall finalize and submit the complete road layout plan along with priority and completion schedule immediately after the award for review by the Employer. He shall ensure that the roads are promptly repaired and maintained against any damages due to movement of traffic/heavy trailers & cranes etc providing motorable access at all times.
- b) The plant site is fully secured against unauthorized access.
- c) Proper housekeeping by systematic and proper disposal of wastes (from dismantling of pile tops, concrete works etc), packing & insulation wastes, steel scrap, cable wastes etc generated during construction / erection works. Suitable disposal sites for each of above shall be identified in the layout and at site in the beginning of the project itself. It shall be ensured that all agencies engaged by the bidder follow the discipline to

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dispose off of earth spoils and wastes at the designated places. Preferably once in a week suitable time slot will be identified for housekeeping by all agencies and suitable instructions shall be issued in this regard.

Bidder may engage a separate agency or identify a gang for collection of wastes and disposal to designated places. Suitable arrangement / tie-up will also be made for periodic disposal of wastes/ scrap from the designated places.

- d) All fabrication areas shall be suitably hard crusted to provide a water free and proper working platforms. Suitable sheds preferably pre engineered structures to be provided for paint shops, fabrication workshops etc for ensuring all weather work conditions for onsite structural works. For the main plant and auxiliary buildings, bidder should preferably plan the works in such a way that structural fabrication is done in suppliers' offsite works / workshops and onsite fabrication works are avoided / kept minimum.
- e) Suitable onsite maintenance workshop for day to day breakdown maintenance heavy plant and equipment like batching plants, cranes, earth moving equipment, welding equipment etc. The workshop shall have stock of frequently needed spares and suitable repair facilities with experienced technicians/mechanics. A central test laboratory equipped with test equipment for routine tests like tests on soil, concrete, bricks, aggregates, welds etc with experienced staff shall be established at the start of the project itself.
- f) All office and covered store buildings of the bidder and its agencies shall be of prefab/ pre-engineered / porta cabin construction. Shabby semi finished constructions in brickwork/ GI / asbestos roof etc shall not be permitted.
- g) First aid facilities and amenities like rest rooms, suitable pre engineered toilets (separate for men and women), drinking water fountains/tanks, canteen, crèche for women workers shall be planned and established at the beginning of the project itself. These facilities shall be distributed nearby plant area to enable easy access by the construction workers and staff and shall be marked on the plant layout.
- h) Proper lighting of all construction / erection areas. Bidder shall erect adequate number of high lighting masts in main plant, offsite, office and store areas for lighting during night. DG sets of adequate capacity shall be provided for emergency backup. The street lighting along the roads shall also be prioritized along with road construction. The construction power ring main shall be planned and erected immediately after the award.
- i) Well planned and coordinated storage and movement of plant, equipment and construction materials. System wise / agency wise storage / laydown areas shall be planned and marked on the plant layout at the beginning itself. Bidder shall ensure that all its agencies comply to the areas allocated to them and follow the designated storage and movement plans. Adequate covered storage shall be constructed for storage of critical equipments like switchgears, MCCs, insulation etc.
- j) Proper access control for construction workers, staff and visitors. Bidder shall ensure that suitable electronic based gate pass system is in place from start of project itself to keep record and track of all workers, staff and visitors entering/exiting the plant premises shift wise on daily basis.
- k) Compliance to all safety requirements as specified in this document. Bidders shall establish a safety centre at the start of the project itself. It shall have a 24X7 manned safety control room in addition to a permanent safety equipment display room, separate training / lecture hall with AV facilities for safety training, store room with

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adequate stock of specified safety equipment, a first aid room and other amenities. Bidder shall install eight (8) Nos. CCTV cameras at all strategic locations in the plant area which shall be linked to the safety control room.

- l) Compliance to all environment and other conditions stipulated by the concerned statutory authorities while according clearance / NOC (No objection certificate) to the project. Bidder shall ensure adequate sprinkling of water by deploying water tankers to prevent the fugitive dust nuisance during construction.
- m) Development of suitable landscape & green belt areas and rainwater harvesting within the plant premises. Bidder shall plan to develop the landscape & green belt areas and rainwater harvesting from the start of the project itself. The landscape and rainwater harvesting plan shall be finalized immediately after award of work and suitable work plan with priority and schedule shall also be finalized thereafter. Top soil before excavation shall be suitably preserved and stacked for landscape and green belt development.
- n) Provision of adequate shelters, water supply, sanitation and lighting in construction workers and staff camps. No camps for workers and staff shall be permitted within the plant premises and Bidder shall make separate arrangement outside the plant premises for locating and development of camps for construction workers and staff. The designated areas shall be suitably developed with infrastructure like roads, drains, water supply and sewerage and shall be free from water logging. Suitable low cost shelters will be provided for the workers. Complete area shall be secured by fencing and shall be provided adequate area lighting. Suitable waste disposal, shopping and recreation facilities will be developed in these camps.

Bidder shall ensure that due importance is given to site management as discussed above and a detailed work plan considering the above aspects is finalized immediately after the award. A senior level executive shall be identified who shall be responsible for implementation of the work plan. Suitable format for progress reporting on site management plan shall be developed and made part of the project progress report. The progress on implementation of above work plan shall be reviewed along with project progress in the monthly project review meetings with Employer. In case the progress on site management plan is unsatisfactory, Employer may withhold up to 1% of the monthly running bill (for civil and site erection works) till such time the required progress is demonstrated. In case in the opinion of Employer, bidder's actions on site management aspects is not adequate, Employer may get the relevant work executed through a separate agency and deduct the expenses incurred from Bidder's bill along with overheads @10 %.

37.00.00 FIELD OFFICE RECORDS

The Contractor shall maintain at his Site Office up-to- date copies of all drawings, specifications and other Contract Documents and any other supplementary data complete with all the latest revisions thereto. The Contractor shall also maintain in addition the continuous record of all changes to the above Contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other Engineering data to indicate as installed conditions of the equipment furnished and erected under the Contract. Such drawings and Engineering data shall be submitted to the Employer in required number of copies.

38.00.00 CONTRACTOR'S MATERIALS BROUGHT ON TO SITE

38.01.00 The Contractor shall bring to Site all equipment, components, parts, materials, including construction equipment, tools and tackles for the purpose of the Works under intimation to the Employer. All such goods shall, from the time of their being brought vest in the Employer,

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but may be used for the purpose of the Works only and shall not on any account be removed or taken away by the Contractor without the written permission of the Employer. The Contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.

38.02.00 The Employer shall have a lien on such goods for any sum or sums which may at any time be due or owing to him by the Contractor, under, in respect of or by reasons of the Contract. After giving a fifteen (15) days notice in writing of his intention to do so, the Employer shall be at liberty to sell and dispose off any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid.

38.03.00 After the completion of the Works, the Contractor shall remove from the Site under the direction of the Employer the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the Employer. If the Contractor fails to remove such materials, within fifteen (15) days of issue of a notice by the Employer to do so then the Employer shall have the liberty to dispose off such materials as detailed under as specified at clause no 38.02.00- of this chapter and credit the proceeds thereto to the account of the Contractor.

39.00.00 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

39.01.00 The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of the Employer and the employees of other Contractors and Sub- Contractors and all public and private property including structures, building, other plants and equipments and utilities either above or below the ground.

39.02.00 The Contractor will ensure provision of necessary safety equipment such as barriers, sign - boards, warning lights and alarms, etc. to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the Employer and the Employers of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his Works and shall make all necessary arrangements with such Employers, related to removal and/or replacement or protection of such property and utilities.

40.00.00 PAINTING

For painting refer Part-A & B of Section VI of Technical specification.

Painting for structures shall conform to the painting specification specified in Part-B under Civil.

Painting for piping shall conform to the painting specification given in Part-B of the respective chapter.

Painting for Electrical equipments/systems shall conform to the painting specification given in Electrical portion of Part-A and Part-B of technical specifications.

41.00.00 INSURANCE

41.01.00 In addition to the conditions covered under the Clause entitled "Insurance" in Section General Conditions of Contract (GCC), the following provisions will also apply to the portion of works to be done beyond the Contractor's own or his Sub-Contractor's manufacturing Works.

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41.02.00 **Workmen's Compensation Insurance**

This insurance shall protect the Contractor against all claims applicable under the Workmen's Compensation Act, 1948 (Government of India). This policy shall also cover the Contractor against claims for injury, disability disease or death of his or his Sub-Contractor's employees, which for any reason are not covered under the Workmen's Compensation Act, 1948. The liabilities shall not be less than the following:

Workmen's Compensation	-	As per Statutory Provisions
Employee's Liability	-	As per Statutory Provisions

41.03.00 **Comprehensive Automobile Insurance**

This insurance shall be in such a form to protect the Contractor against all claims for injuries, disability, disease and death to members of public including the Employer's men and damage to the property of other arising from the use of motor vehicles during on or off the Site operations, irrespective of the Ownership of such vehicles. The liability covered shall be as herein indicated :

Fatal Injury	:	Rs.100,000 each person
	:	Rs.200,000 each occurrence
Property Damage	:	Rs.100,000 each occurrence

41.04.00 **Comprehensive General Liability Insurance**

41.04.01 The insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members of public or damage to property of others, due to any act or omission on the part of the Contractor, his agents, his employees, his representatives and Sub-Contractors or from riots, strikes and civil commotion. This insurance shall also cover all the liabilities of the Contractor arising out of the Clause entitled "Defence of Suits" in Section General Conditions of Contract (GCC).

41.04.02 The hazards to be covered will pertain to all the Works and areas where the Contractor, his Sub-Contractors, his agents and his employees have to perform work pursuant to the Contract.

41.05.00 The above are only illustrative list of insurance covers normally required and it will be the responsibility of the Contractor to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the Contract.

42.00.00 **UNFAVORABLE WORKING CONDITIONS**

The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects during inclement weather conditions, like monsoon, storms, etc. and during other unfavorable construction conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the Contractor in a proper and satisfactory manner in the performance of such Works and with the concurrence of the Employer. Such unfavorable construction conditions will in no way relieve the Contractor of his responsibility to perform the Works as per the schedule.

43.00.00 **PROTECTION OF MONUMENTS AND REFERENCE POINTS**

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The Contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc. which he may come across during the course of performance of his Works either during excavation or elsewhere, are properly protected and handed over to the Employer. Similarly the Contractor shall ensure that the bench marks, reference points, etc., which are marked either with the help of Employer or by the Employer shall not be disturbed in any way during the performance of his Works. If, any work is to be performed which disturb such reference, the same shall be done only after these are transferred to other suitable locations under the direction of the Employer. The Contractor shall provide all necessary materials and assistance for such relocation of reference points etc.

44.00.00 WORK & SAFETY REGULATIONS

44.01.00 General

- i) The contractor shall comply with all the requirements of "The Building and Other Construction Workers (Regulation of Employment & Conditions of Service) Act," 1996 and its Central Rule 1998 / State Rules and any other statutory requirements as applicable.
- ii) The Contractor shall follow NVVN Safety Rules as issued from time to time with respect to safety in construction & erection.
- iii) The contractor shall have the approved Safety, Health and Environment (SHE) Policy in respect of Safety and health of Building Workers and it shall be circulated widely and displayed at conspicuous place in Hindi and local language understood by the majority of the workers. A copy of the safety policy should be submitted to Engineer in charge.
- iv) The contractor shall submit the safety plan comprising of methods to implement the Safety Policy/ Rules, Risk assessment and ensuring Safety at work areas, Safety audits, inspections and its compliance, Supervision and responsibility to ensure Safety at various levels, Safety training to employees, review of Safety and accident analysis, ensure Health and Safety Procedures to prevent accidents to Engineer I/c for approval as per the format of Safety plan as annexed at Annexure - III.
- v) The Contractors shall ensure proper safety of all the workmen, materials, plant and equipment belonging to him or to the Employer or to others, working at the Site.
- vi) All equipments used in construction and erection by the contractor shall meet BIS / International Standards and where such standards do not exist, the Contractor shall ensure these to be absolutely safe. All equipments shall be strictly operated and maintained by the contractor in accordance with manufacturer's operation manual. The contractor should also follow Guidelines / Rules of the Employer in this regard.
- vii) The Contractors shall provide suitable latest Personal Protective Equipments of prescribed standard to all their employees and workmen according to the need. The Engineer I/c shall have the right to examine these safety equipments to determine their suitability, reliability, acceptability and adaptability. The contractor should also ensure these before their use at worksite.
- viii) The Contractor shall provide safe working conditions to all workmen and employees at his workplace including safe means of access, railings, stairs, and ladders, scaffolding, work platforms, toe boards etc. The scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection of scaffolds, access, work platforms etc. shall be good and the contractor shall use standard quality of material.

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ix) The Contractor shall follow and comply with all the Safety Rules, standards, code of practices of NVVN and relevant provisions of applicable laws pertaining to the safety of workmen, employees, plant and equipment as may be prescribed from time to time without any protest or contest or reservation. In case of any unconformity between statutory requirement and the Safety Rules of the Employer referred above, the latter shall be binding on the Contractor unless the statutory provisions are more stringent. As and when required he can refer / obtain copy of NVVN safety documents as stated above.

x) The contractor shall have his own arrangements with nearby hospitals for shifting and treatment of sick and injured.

The medical examination of the workers employed in hazardous areas shall be conducted as per Rule 223 of The Building and Other Construction Worker (Regulation of Employment and Condition of Service) Central Rule 1998, their health records shall be maintained accordingly and to be submitted to Engineer I/c when asked for. If any worker found suffering from occupational health hazard, the worker should be shifted to suitable place of working and properly treated under intimation to Engineer I/c. The medical fitness certificate to be submitted to Engineer (I/c).

xi) First Aid boxes equipped with requisite articles as specified in the Rule 231 of The Building and Other Construction Worker (Regulation of Employment and Condition of Service) Central Rule 1998 shall be provided at construction sites for the use of workers. Training has to be provided on first aid to workmen & office bearers working at site.

44.01.01 **Emergency Action Plan**

The contractor shall prepare an emergency action plan approved by his competent authority to handle any emergency occurred during construction work. Regular mock drills shall be organized to practice this emergency plan. The Emergency Action Plan should be widely circulated to all the employees and suitable infrastructure shall be provided to handle the emergencies.

44.01.02 **Scaffolding**

The contractor shall take all precautions to prevent any accidental collapse of scaffolding or fall of persons from scaffolding. The contractor should ensure that scaffolding are designed by a competent person and its erection and repairs should be done under the expert supervision. The scaffolding shall meet the required strength and other requirements for the purpose for which the scaffold is erected. The material used for scaffold should conform to the BIS / International standards.

44.01.03 **Opening**

The contractor shall ensure that there is no opening in any working platform/any floor of the building, which may cause fall of workers or material. When ever an opening on a platform/any floor of the building is unavoidable, the opening should be suitably fenced and necessary measures for protection against falling objects or building workers from such platform are taken by providing suitable safety nets, safety belts or other similar means.

44.01.04 **Explosives**

The contractor shall take all precautions while handling, using, storing or transporting of all explosives. Before usage of any explosive necessary warning / danger signals be erected at conspicuous places to warn the workers and general public. The contractor should strictly

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ensure that all measures and precautions required to be complied for use, handling, storing or transportation of explosives under the rules framed under the Explosives Act, 1884.

44.02.00 **Fencing of Machinery**

The contractor shall provide suitable fencing or guard to all dangerous and moving parts of machinery.

The contractor shall not allow any of the employees to clean, lubricate, repair, adjust or examine during machinery in motion, which may cause injury to the person.

44.03.00 **Carrying of Excessive Weight by a Worker**

The worker shall not be allowed to lift by hand or carry over his head, back or shoulder more than the maximum limit set by the prescribed rules for the construction Workers.

44.04.00 **Dangerous and Harmful Gases / Equipment**

The contractor shall ensure that the workers are not exposed to any harmful gases during any construction activity including excavation, tunneling, confined spaces etc.

The contractor should not allow any worker to go into the confined space unless it is certified by Engineer (I/c) to be safe and fit for the entry to such work place. Proper record and work permits should be followed to carry out such works.

44.05.00 **Overhead Protection**

The contractor shall ensure that any area exposed to risk of falling materials, articles or objects is roped off or cordoned off or otherwise suitably guarded from inadvertent entry of any person.

Wherever there is a possibility of falling of any material, equipment or construction workers while working at heights, a suitable and adequate safety net should be provided. The safety net should be in accordance with BIS Standards.

44.06.00 **Working at Heights**

All working platforms, ways and other places of construction work shall be free from accumulations of debris or any other material causing obstructions and tripping.

Wherever workers are exposed to the hazard of falling into water, the contractor shall provide adequate equipment for saving the employees from drowning and rescuing from such hazards. The contractor shall provide boat or launch equipped with sufficient number of life buoys, life jackets etc. manned with trained personnel at the site of such work.

Every opening at elevation from ground level through which a building worker, vehicle, material equipment etc. may fall at a construction work shall be covered and/or guarded suitably by the contractor to prevent such falls.

Wherever the workers are exposed to the hazards of falling from height, the contractor shall provide full harness safety belts fitted with fall arresting systems to all the employees working at higher elevations and life line of 8 mm diameter wire rope with turn buckles for anchoring the safety belts while working or moving at higher elevations. Safety nets shall also be provided for saving them from fall from heights and such equipment should be in accordance with BIS standards.

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Wherever there is a possibility of falling of any material, equipment or construction workers while working at heights, a suitable and adequate safety net should be provided. The safety net should be in accordance with BIS Standards.

The contractor shall provide standard prefabricated ladders on the columns where the workers are required to use them as an access for higher elevations till permanent staircase is provided. The workers shall be provided with safety belts fitted with suitable fall arresting system (Fall arrestors) for climbing/getting down through ladders to prevent fall from height.

44.07.00 **Handling of Hazardous Chemicals**

The Contractor will notify well in advance to the Engineer I/c of his intention to bring to the Site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. NVVN shall have the right to prescribe the conditions, under which such container is to be stored, handled and used during the performance of the works and the Contract shall strictly adhere to and comply with such instructions. The Engineer I/c shall have the right at his sole discretion to inspect any such container or such construction plant / equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by NVVN and NVVN shall not entertain any claim of the Contractor towards additional safety provisions / conditions to be provided for / constructed.

Further, any such decision of the Engineer I/c shall not, in any way, absolve the Contractor of his responsibilities and in case, use of such a container or entry thereof into the Site area is forbidden by NVVN, the Contractor shall use alternative methods with the approval of the NVVN without any cost implication to the NVVN or extension of work schedule.

Where it is necessary to provide and / or store petroleum products or petroleum mixtures and explosives, the Contractor shall be responsible for carrying-out such provision and / or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosives Act 1948, and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of the Engineer I/c. In case any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the Contractor shall be responsible for obtaining the same.

The Contractor shall be fully responsible for the safe storage of his and his Sub-contractor's radio-active sources in accordance with BARC/DAE (Bhabha Atomic Research Centre/ Department of Atomic Energy, Govt. of India) Rules and other applicable provisions. All precautionary measures stipulated by BARC/DAE in connection with use, the contractor would take storage and handling of such material.

The contractor shall provide suitable personal protective equipments to the workers who are handling the hazardous and corrosive substances including alkalis and acids.

As a precautionary measure the contractor should keep the bottles filled with distilled water in cupboard / Boxes near work place for emergency eye wash by worker exposed to such hazardous chemicals.

44.08.00 **Eye Protection**

The contractor shall provide suitable personal protective equipment to his workmen depending upon the nature of hazards and ensure their usage by the workers engaged in operations like welding, cutting, chipping, grinding or similar operations which may cause injuries to his eyes.

44.09.00 **Excavation**

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The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding material or article from any bank or side of such excavation which is more than one and a half meter above his footing by providing adequate piling, shoring, bracing etc. against such bank or sides.

Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.

44.10.00 **Electrical Hazards**

The contractor should ensure that all electrical installations at the construction work comply with the requirements of latest electricity acts / rules.

The contractor shall take all adequate measures to prevent any worker from coming into physical contact with any electrical equipment or apparatus, machines or live electrical circuits which may cause electrical hazards during the construction work. The contractor shall provide the sufficient ELCBs / RCCBs for all the portable equipments, electrical switchboards, distribution panels etc. to prevent electrical shocks.

The contractor should ensure use of single / double insulated hand tools or low voltage i.e., 110 volts hand tools.

The contractor should also ensure that all temporary electrical installations at the construction works are provided with earth leakage circuit breakers.

44.11.00 **Vehicular Traffic**

The contractor should employ vehicle drivers who hold a valid driving license under the Motor Vehicles Act, 1988.

44.12.00 **Lifting Appliances, Tools & Tackles, Lifting Gear and Pressure Plant & Equipment etc.**

The contractor shall ensure all the lifting appliances, tools & tackles including cranes etc., lifting gear including fixed or movable and any plant or gear, hoists, Pressure Plant and equipment etc. are in good condition and shall be examined by competent person and only certified shall be used at sites. Periodical Examination and the tests for all lifting / hoisting equipment & tackles shall be carried out. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by the Engineer I/c or by the person authorized by him.

44.13.00 **Excessive Noise, Vibration**

The contractor shall take adequate measures to protect the workers against the harmful effect of excessive noise or vibration. The noise should not exceed the limits prescribed under the concerned rules, Noise Pollution (Regulation and Control) Rules, 2000.

44.14.00 **Electrical Installations**

44.14.01 The Contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment belonging to the Employer or other contractors under any circumstances, whatsoever, unless expressly permitted in writing by the Engineer I/c to handle such fuses, wiring or electrical equipment.

Before the Contractor connects any electrical appliances to any plug or socket belonging to the other contractor or the NVVN, he shall

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- i) Satisfy the Engineer I/C that the appliance is in good working condition;
- ii) Inform the Engineer I/C of the maximum current rating, voltage and phases of the appliances;
- iii) Obtain permission of the Engineer I/C detailing the sockets to which the appliances may be connected.

The Engineer I/C will not grant permission to connect until he is satisfied that:

The appliance is in good condition and is fitted with suitable plug; having earth connection with the body.

Wherever armored / metallic sheathed multi core cable is used, the same armored / sheathed should be connected to earth.

- iv) No repair work shall be carried out on any live equipment. The Engineer I/c must declare the equipment safe and a permit to work shall be issued by the NVVN / contractor as the case may be to carry out any repair / maintenance work. While working on electric lines / equipments whether live or dead, suitable type and sufficient quantity of tools will have to be provided by the contractor to electricians / workmen / Officers.
- v) The contractor shall employ necessary number of qualified, full time Electricians / Electrical Supervisors to maintain his temporary electrical installation.

The installations are provided with suitable ELCBs and RCCBs wherever required.

44.15.00 **Safety Organisation**

44.15.01 The contractor shall employ full time safety officer(s) as per requirement stipulated in NVVN Safety Rules, exclusively to supervise safety aspects of the equipments and workmen, who will coordinate with the NVVN Safety Officer. Further requirement of safety officers, if any, shall be guided by Rule 209 of The Building and Other Construction Worker (Regulation of Employment and Conditions of Service) Central Rule 1998. In case the work is being carried out through subcontractor, the employees / workmen of the sub-contractor shall also be considered as the contractor's employees/workmen for the above purpose.

44.15.02 The name and address of such Safety Officer of the Contractor will be promptly informed in writing to the EIC with a copy to the Project Safety Officer before he starts work or immediately after any change of the incumbent is made during currency of the Contract.

44.16.00 **Reporting of Accident and Investigation**

In case any accident occurs during the construction / erection or other associated activities undertaken by the Contractor thereby causing any near miss, minor or major or fatal injury to his employees due to any reason, whatsoever, it shall be the responsibility of the Contractor to promptly inform the same to the Engineer I/C, NVVN Safety Officer with a copy to NVVN Head of Project in the prescribed form and also to all the authorities envisaged under the applicable laws.

44.17.00 **Right to stop Work**

44.17.01 The Engineer I/C shall have the right at his sole discretion to stop the work, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipments. In such cases, the contractor

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shall be informed in writing about the nature of hazards and possible injury / accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary appeal against the order of stoppage of work to the Project Manager within 3 days of such stoppage of work and decision of the Project Manager in this respect shall be conclusive and binding on the Contractor.

44.17.02 The Contractor shall not be entitled for any damages / compensation for stoppage of work, {Sub-Clause XVIII (I)} due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages.

44.18.00 Fire Protection

The contractor shall provide sufficient fire extinguishers at place /s of work. The fire extinguishers shall be properly maintained as per relevant BIS Standards. The employees shall be trained to operate the fire extinguishers / equipment.

44.19.00 Penalties

I If the Contractor fails in providing safe working environment as per the Safety Rules of NVVN or continues the work even after being instructed to stop the work by the Engineer I/C as provided in Clause XVIII (1) above, the Contractor shall be penalized at the rate of Rs. 25,000/- per day or part thereof till the instructions are complied with and so certified by the Engineer I/C. However, in case of accident, the provisions contained in Sub-Clause XX (II) below shall also apply in addition to the penalties mentioned in this sub-clause.

II If the Contractor does not take all safety precautions and / or fails to comply with the Safety Rules as prescribed by the Employer or under the applicable law for the safety of the plant and equipment and for the safety of personnel and the contractor does not prevent hazardous conditions which cause injury to this own employees or employees of other contractors, or NVVN's employees or any other person who are at the Site or adjacent thereto, the Contractor shall be responsible for payment of penalty to NVVN as per the following schedule:-

a) Fatal injury or accident causing death:

Penalty @10% of contract value or Rs. 5,00,000/- per person, which ever is less.

b) Major injuries or accident causing 25% or more permanent disablement to workmen or employees:

Penalty @2.5% of contract value or Rs. 1,00,000/- per person which ever is less

Permanent disablement shall have the same meaning as indicated in The Workmen's Compensation Act' 1923. The penalty mentioned above shall be in addition to the compensation payable to the workmen / employees under the relevant provisions of the Workmen's Compensation Act' 1923 and rules framed there under or any other applicable laws as applicable from time to time.

III If any contractor worker found working without using the safety equipment like safety helmet, safety shoes, safety belts, etc. or without anchoring the safety belts while working at height the Engineer I/c / Safety Officer of NVVN shall have the right to penalize the contractor for Rs. 200/- per person per day and such worker shall be

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sent out of the workplace immediately and shall not be allowed to work on that day. Engineer I/c / Safety Officer of NVVN will also issue a notice in this regard to the contractor.

- IV If two or more fatal accidents occur at same NVVN site under the control of contractor during the period of contract and he has
- (1) not complied with keeping adequate PPEs in stock or
 - (2) defaulted in providing PPEs to his workmen
 - (3) not followed statutory requirements / NVVN safety rules
 - (4) been issued warning notice/s by NVVN head of the project on non observance of safety norms
 - (5) not provided safety training to all his workmen, the contractor can be debarred from getting tender documents in NVVN for two years from the date of last accident.

The safety performance will also be one of the overriding criteria for evaluation of overall performance of the contractors by NVVN. The contractor shall submit the accident data including fatal / non-fatal accidents for the last 3 years where he has undertaken the construction activities Projects-wise along with the tender documents. This will also be considered for evolution of tender documents. If the information given by the contractor found incorrect, his contract will be liable to be terminated.

44.20.00 The Contractor will make available minimum quantity of all safety equipments and safety PPEs of required specifications as per suggestive list included bidding documents as a part of "List of minimum T & P". Further Contractor will ensure availability of additional requirement for individual worker and safety equipment as per site requirement during execution of the contract till its completion.

44.21.00 The Contractor shall abide by the following during Construction and Erection activities:

- I. Chain pulley block shall not be used for loads more than 2 (Two) tonne.
- II. Hydra shall not be used for material transport.
- III. Cage shall necessarily be provided to Monkey ladders of height more than 4 m.
- IV. Fencing shall be provided to all Electrical Distribution boards and transformers etc.

44.21.00 Award

If the Contractor's performance on safety front is found satisfactory i.e. without any fatal/ reportable accident in the year of consideration; he may be considered for suitable award "ACCIDENT FREE SAFETY MERITORIOUS AWARD" as per scheme of the employer.

45.00.00 FOREIGN PERSONNEL

45.01.00 The Contractor shall submit to the Employer data on all personnel he proposes to bring into India from abroad for the performance of the Works under the Contract, at least sixty (60) days prior to their departure to India. Such data will include for each person the name, his present address, his assignment and responsibility in connection with the works, and a short resume of his qualification, experience etc. in relation to the work to be performed by him.

45.02.00 Any person unsuitable and unacceptable to the Employer shall not be brought to India. Any person brought to India, if found unsuitable or unacceptable by the Employer, the Contractor

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shall within a reasonable time make alternate arrangements for providing a suitable replacement and repatriation of such unsuitable personnel.

45.03.00 No person brought to India for the purposes of the works shall be repatriated without the consent of the Employer in writing, based on a written request from the Contractor for such repatriation giving reasons for such an action to the Employer. The Employer may give permission for such repatriation provided he is satisfied that the progress of work will not suffer due to such repatriation.

45.04.00 The cost of passports, visas and all other travel expenses to and from India, incurred by the Contractor shall be to his account. The Employer will not provide any residential accommodation and/or furniture for any of the Contractor's personnel including foreign personnel and Contractor shall make his own arrangements for such facilities in the area allotted at Site, to him by the Employer for that purpose.

45.05.00 The Contractor and his expatriate personnel shall respect all Indian Acts, Laws, rules and regulations and shall not in any way interfere with Indian political and religious affairs and shall conform to any other rules and regulations which the Government of India and the Employer may establish from time to time, on them. The Contractor's expatriate personnel shall work and live in close co-operation and coordination with their co-workers and the community and shall not engage themselves in any other employment neither part-time or full-time nor shall they take part in any local politics.

45.06.00 The Employer shall assist the Contractor, to the extent possible, in obtaining necessary permits to travel to India and back, by issue of necessary certificates and other information needed by the Government agencies.

46.00.00 FOUNDATION DRESSING & GROUTING FOR EQUIPMENT/ EQUIPMENT BASES

46.01.00 The surfaces of foundations shall be dressed to bring the top surface of the foundations to the required level, prior to placement of equipment/equipment bases on the foundations.

46.02.00 All the equipment/ equipment bases, shall be grouted and finished by bidder as per these specifications unless otherwise recommended by the equipment manufacturer.

46.03.00 The concrete foundation surfaces shall be properly prepared by bidder by chipping, grinding as required to bring the top of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength.

46.04.00 Grout

The grout for equipment foundation shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm² at 28 days. The grout shall be ready mix non-shrink, chloride - free, cement based, free flowing, non-metallic grout as recommended by equipment manufacturer. The ready mix grout shall be of reputed make as approved by the Employer.

The Grout shall have good flowability even at very low water/ grout powder ratio.

The Grout shall have characteristics of controlled expansion to be able to occupy its original volume to fill the voids and to compensate for shrinkage. Grout shall be of pre-mix variety so that only water needs to be added before use.

The mixing of the Grout shall conform to the recommendations of the manufacturer of the Grout.

46.05.00 Placing of Grout

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46.05.01 After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout, a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back & forth to push the grout into every part of the space under the base.

46.05.02 The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.

46.05.03 In addition to the above, recommendations of Grout manufacturer shall also be followed.

46.06.00 **Finishing of the Edges of the Grout**

The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothed with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.

46.07.00 **Checking of Equipment after Grouting**

After the grout is set and cured, the Contractor shall check and verify the alignment of equipments, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings, etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during such post grouting check-up and verifications. Such pre and post grout records of alignment details shall be maintained by the Contractor in a manner acceptable to the Employer.

47.00.00 **SHAFT ALIGNMENTS**

All the shafts of rotating equipment shall be properly aligned to those of the matching equipments to as perfect an accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. The vibration level of rotating equipments measured at bearing housing shall conform to Zone A of ISO 10816. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

48.00.00 **DOWELLING**

All the motors and other equipment shall be suitably doweled after alignment of shafts with tapered machined dowels as per the direction of the Employer.

49.00.00 **CHECK OUT OF CONTROL SYSTEMS**

After completion of wiring, cabling furnished under separate specification and laid and terminated by the Employer, the Contractor shall check out the operation of all control systems for the equipment furnished and installed under these specifications and documents.

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50.00.00 COMMISSIONING SPARES

50.01.00 It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within thirty (30) days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.

50.02.00 These spare will be received and stored by the Contractor atleast 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilised as and when required. The unutilised spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.

51.00.00 CABLING

51.01.00 All cables shall be supported by conduits or cable tray run in air or in cable channels. These shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turn made of symmetrical bends or fittings. When cables are run on cable trays, they shall be clamped at a minimum intervals of 2000mm or otherwise as directed by the Employer.

51.02.00 Each cable, whether power or control, shall be provided with a metallic or plastic tag of an approved type, bearing a cable reference number indicated in the cable and conduit list (prepared by the Contractor), at every 5 meter run or part thereof and at both ends of the cable adjacent to the terminations. Cable routing is to be done in such a way that cables are accessible for any maintenance and for easy identification.

51.03.00 Sharp bending and kinking of cables shall be avoided. The minimum radii for PVC insulated cables 1100 V grade shall be 15 D where D is the overall diameter of the cable. Installation of other cables like high voltage, coaxial, screened, compensating, mineral insulated shall be in accordance with the cable manufacturer's recommendations. Wherever cables cross roads and water, oil, sewage or gaslines, special care should be taken for the protection of the cables in designing the cable channels.

51.04.00 In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop fault at a later date.

51.05.00 Control cable terminations shall be made in accordance with wiring diagrams, using identifying codes subject to the Employer's approval. Multicore control cable jackets shall be removed as required to train and terminate the conductors. The cable jacket shall be left on the cable, as far as possible, to the point of the first conductor branch. The insulated conductors from which the jacket is removed shall be neatly twined in bundles and terminated. The bundles shall be firmly but not tightly tied utilising plastic or nylon ties or specifically treated fungus protected cord made for this purpose. Control cable conductor insulation shall be securely and evenly cut.

51.06.00 The connectors for control cables shall be covered with a transparent insulating sleeve so as to prevent accidental contact with ground or adjacent terminals and shall preferably terminate in Elmex terminals and washers. The insulating sleeve shall be fire resistant and shall be long enough to over pass the conductor insulation. All control cables shall be fanned out and connection made to terminal blocks and test equipment for proper operation before cables are corded together.

52.00.00 EQUIPMENT DELIVERY AND ERECTION

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52.01.00

General Requirements

- (a.) This part covers Contractor's responsibilities for packing, shipping, ware-housing and the installation of all equipment and materials furnished and installed under this specification.
- (b.) The Contractor shall submit for Employer's approval draft manual for Equipment Delivery and Erection (EDE Manual) covering detailed instructions, write up, technical data, drawings, check-lists, documentation formats for all activities after equipment manufacture upto installation of equipment. This manual shall cover general instructions for all equipment and specific instructions for individual equipment wherever required and shall include at least the following:
 - (1.) Instructions for packing, shipping, receiving handling, ware-housing and storage.
 - (2.) Instructions for location and installation of equipment furnished by this specification.
 - (3.) Installation drawings for field mounted equipment, panels, cubicles and other equipment covered under this specification.
 - (4.) Instruction relating installation of piping/ tubing, support and routing drawings of impulse pipes/signal tubes and tube/cable trays.
 - (5.) Check lists and quality assurance hold points.
 - (6.) Format for all related documentation.
- (c.) The EDE Manual shall conform to the requirements of this specification, all applicable codes and standards, recommendations of equipment manufacturers and accepted good engineering practices and shall be subject to Employer approval during detailed engineering.
- (d.) The Contractor shall ensure that all work under this part shall be performed as per the requirements of this specification, Employer approved EDE Manual and drawing/documents approved by the Employer during detailed engineering.

52.02.00

Crating

- (a.) All equipment and materials shall be suitably coated, wrapped, or covered and boxed or crated for moist humid tropical shipment and to prevent damage or deterioration during handling and storage at the site.
- (b.) Equipment shall be packed with suitable desiccants, sealed in water proof vapour-proof wrapping and packed in lumber of plywood enclosures, suitably braced, tied and skidded. Lumber enclosures shall be solid, not slatted.
- (c.) Desiccants shall be either silica gel or calcium sulphate, sufficiently ground to provide the required surface area and activated prior to placing in the packaging. Calcium sulphate desiccants shall be of a chemical nature to absorb moisture. In any case, the desiccant shall not be of a type that will absorb enough moisture to go into solution. Desiccants shall be packed in porous containers, strong enough to withstand handling encountered during normal shipment. Enough desiccant shall be used for the volumes enclosed in wrapping.

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- (d.) Review by the Employer of the Contractor's proposed packaging methods shall not relieve the Contractor of responsibility for damage or deterioration to the equipment and materials specified.
- (e.) All accessory items shall be shipped with the equipment. ; Boxes and crates containing accessory items shall be marked so that they are identified with the main equipment. The contents of each box and crates shall be indicated by markings on the exterior.
- (f.) All boxes, crates, cases bundles, loose pieces, etc. shall be marked consecutively from No.1 upward throughout all shipments from a given port to completion of the order without repeating the same number.
- (g.) An itemized list of contents shall be enclosed inside each case and one other copy securely fastened to the outside of the case in a tin or light weight sheet metal envelope or pocket. The lists shall be plainly marked and placed in accessible locations to facilitate receipt and inspection. The packing list shall indicate whether shipment is partial or complete and shall incorporate the following information on each container, etc., according to its individual shipping number:
 - a) Export case markings
 - b) Case number
 - c) Gross weight and net weight in Kilograms
 - d) Dimensions in centimeters
 - e) Complete description of material
- (h.) Packaging or shipping units shall be designed within the limitations of unloading facilities and the equipment which will be used for transport. Complications involved with ocean shipment and the limitations of ports, railways and roads shall be considered. It shall be the Contractor's responsibility to investigate these limitations and to provide suitable packaging to permit safe handling during transit and at the job site.
- (i.) Electrical equipment, control and instrumentation shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, motor pump shafts, bearing and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection.
- (j.) Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures.
- (k.) Coated surfaces shall be protected against impact, abrasion, discolouration and other damage. Surfaces which are damaged shall be repaired.
- (l.) All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be closed with forged steel plugs. All pipings, tubing, and conduit equipment and other equipment openings shall be sealed with metallic or other rough usage covers and tapped to seal the interior of the equipment piping, tubing, or conduit.
- (m.) Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the plant site.

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- (n.) Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.
- (o.) While packaging the material, care shall be taken for the limitation from the point of view of availability of railway wagon sizes in India.

52.03.00

Factory Assembly

- (a.) Instrument enclosures shall be supplied and erected completely in the factory with instrument, air supply and blow down piping with necessary valves, fittings, etc. and also all electrical wiring between the instruments and the enclosure terminal blocks. Control panel and cubicles shall also be fully wired in the factory. Control panel mounted equipments are to be dismantled from the panels before shipment and individually packed for shipment. Electronic control modules of the plug-in type are to be removed from equipment racks after factory checkout are individually packed for shipment. Other equipment shall be fully assembled at the factory, except for necessary shipping splits in panels.
- (b.) All separately packaged accessories items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing slip, indicating what is in that carton only, shall be attached to the outside and inside of each container used for packing.

A master packing slip covering all accessories items for a given piece of equipment which are shipped in separate containers, shall be attached to one container.

52.04.00

Equipment Installation

(a.) General Requirements

- (1.) The Contractor shall furnish all construction materials, tools and equipment and shall perform all work required for complete installation of all control and instrument equipment furnished under this specification.
- (2.) Contractor shall prepare detailed installation drawings for each equipment furnished under this specification for Employer's approval. Installation of all equipment/systems furnished by this specification shall be as per Employer's approval.
- (3.) Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. The procedures shall be acceptable to the Employer.
- (4.) The Contractor shall coordinate his work with other suppliers where their instruments and devices are to be installed under specifications.

(b.) Installation Materials

All materials required for installation, testing and commissioning of the equipment shall be furnished by the Contractor.

(c.) Regulatory Requirements

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All installation procedures shall conform with the accepted good engineering practice and with all applicable governmental laws, regulations and codes.

(d.) **Cleaning**

All equipment shall be cleaned of all sand, dirt and other foreign materials immediately after removal from storage and before the equipment is brought inside the power plant building or to other installation sites. All piping and tubes shall be air blown.

(e.) **Equipment Assembly**

Equipment installed under these specifications shall be assembled if shipped unassembled. The equipment shall be dismantled and reassembled as required to perform the installation and commissioning work described in these specifications.

(f.) **Equipment Setting**

Field mounted instruments and accessories shall be bracket or sub panel mounted on the nearest suitable firm steel work or masonry. The brackets, stands, supports and other miscellaneous hardware required for mounting instruments and accessories such as receiver gauge, air set, valve manifold, purge-meter etc. shall be furnished and installed. No field mounted instruments shall be installed such that it depends for support or rigidity on the impulse piping or on electrical connection to it.

Indicating type field mounted instruments shall be installed in such a way that centre of indicating dial shall be about 1600-1800mm from operating floor level. Non-indicating type field instruments shall be installed such that operating handle of manifold block / isolating cock comes within 1600 mm from operating floor level.

(g.) **Free-Standing Equipment**

Free-standing Cabinets shall be attached to the floor, concrete equipment bases or supporting steel as indicated on the manufacturer's drawings and the Employer's Plant Arrangement Drawings. The cabinets shall be shimmed for proper alignment before bolting them to the floor. Adjacent enclosures shall be shimmed to maintain mutually level appearance before they are attached to floor. Vibration dampening mounts shall be installed between supporting structures and panels when specified.

(h.) **Non-free Standing Equipment**

(1.) Non-free standing local enclosures and cabinets shall be mounted in accessible locations on columns, walls, or stands in locations as indicated on the Employer's Plant Arrangement Drawings. Bracket and stands shall be fabricated as required to install the local enclosures and cabinets in a workman like manner.

(2.) Rough edges and welds on all fabricated supports shall be ground smooth. The supports shall be finished with two coats of primer and two coats of paint as specified in this part.

(i.) **Equipment Location**

(1.) All individual items of equipment not located in cabinets or on panels and racks are located approximately according to the floor elevation and the nearest building column designated by the Employer.

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- (2.) Solenoid valves not located in enclosures or mounted on valves shall be mounted in easily accessible protected locations near the components with which they are associated.
- (3.) All brackets, stands, supports and other miscellaneous hardware required for mounting devices shall be furnished and installed.
- (4.) Thermometers shall be installed in the process lines and ducts as required and adjusted for ease in reading.
- (5.) Permanent temperature wells on the main steam, hot reheat and cold reheat piping shall not be installed until steam blowing has been completed. Temporary temperature wells shall be installed in the main and reheat steam piping during steam blow and discarded after completion.
- (6.) Any required adapting hardware such as pipe bushings, nipples, drilled caps and the like shall be provided for complete installation of control devices into process connections.

For location of C&I related equipment/devices, the requirement specified elsewhere in the technical specification may be referred.

(j.) **Installation of Field Mounted Instruments and Devices**

The Contractor shall submit installation drawings for all field mounted equipment furnished under this specification for Employer's approval. These drawings shall meet the requirements of this specification, installation drawings, applicable codes and standards and recommendations of manufacturers of instruments/devices. All installation work under this specification shall be strictly as per installation drawings approved by the Employer during detailed engineering stage.

In addition to above relevant Portion as specified elsewhere in technical specification may be referred.

(k.) **Piping Connections**

- (1.) All equipment having piping connections shall be levelled, aligned and wedged in place but shall not be grouted or bolted prior to the initial fitting and alignment of connecting piping. All equipment shall, however, be grouted or bolted to its foundation prior to final bolting or welding of the connection piping.
- (2.) All flanged joints shall be checked and retightened after approximately 10 days of operation at normal operating temperature.

(l.) **Equipment Checkout**

- (1.) All equipment shall be cleaned after installation. Equipment subject to pressure differentials shall be checked for leakage.
- (2.) After erection, all equipment having moving parts, having electrical apparatus, or subject to pressure differentials shall be trial-operated.

(m.) **Defects**

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- (1.) All defects in erection shall be corrected to the satisfaction of the Employer and the Project Manager. The dismantling and reassembly of Contractor furnished equipment to remove defective parts, replace parts, or make adjustments shall be included as a part of the work under these specifications.
- (2.) The removal of control and instrument equipment in order to allow bench calibration, if required, and the re-installation of the said equipment after calibration shall also be included as a part of the work under these specifications.

(n.) Equipment Protection

- (1.) All equipment to be erected under these specifications shall be protected from damage of any kind from the time of contract award until commissioning of each unit.
- (2.) The equipment shall be protected during storage as described herein.
- (3.) Equipment shall be protected from weld spatter during construction.
- (4.) Suitable guards shall be provided for protection of personnel on all exposed rotating or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy removal and maintenance.
- (5.) Equipment having glass components such as gauges, or equipment having other easily breakable components, shall be protected during the construction period with plywood enclosures or other suitable means. Broken, stolen, or lost components shall be replaced by the Contractor.
- (6.) Machine finished surfaces, polished surfaces, or other bare metal surfaces which are not to be painted, such as machinery shafts and couplings shall be provided temporary protection during storage and constructional periods by a coating of a suitable non-drying, oily type, rust preventive compound.

53.00.00 WELDING - SPECIAL REQUIREMENTS

If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed under separate specifications, the requirements shall be submitted to the Project Manager in advance of commencement of erection work.

54.00.00 DEVIATIONS DISPOSITIONING:

Any deviation to the contract and employer approved documents shall be properly recorded in the format prescribed by NVVN. All the deviations shall be brought to the knowledge of employer's representative for suitable dispositioning.

55.00.00 NON-DESTRUCTIVE TESTING (NDT):

The contractor shall record results of NDTs carried out at site in the format acceptable to employer. All the radiographs & its report duly signed & correlated to the job shall be handed over to the employer. Sensitivity of all the test equipment shall be compatible to the job & acceptance norms agreed.

56.00.00 TESTING EQUIPMENT & FACILITIES:

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Contractor shall provide the testing equipment and facilities necessary to carry out tests & inspections.

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ANNEXURE-I

STANDARD CHECKLIST

COMMISSIONING/TESTING ESSENTIAL PRE-REQUISITE

1. MECHANICAL

(A.) VALVES

- (1.) MANUALLY OPERATED VALVE
- (2.) ELECTRICALLY OPERATED VALVE
- (3.) PNEUMATICALLY ACTUATED VALVE
- (4.) HYDRAULICALLY ACTUATED VALVE
- (5.) SAFETY VALVE
- (6.) ELECTROMATIC RELIEF VALVE
- (7.) BUTTERFLY VALVE (ELECTRICALLY OPERATED)
- (8.) BUTTERFLY VALVE (MANUALLY OPERATED)
- (9.) BUTTERFLY VALVE (FOUR WAY-ELECTRICAL)
- (10.) NON-RETURN VALVE (INCLUDING HYDRAULIC/PNEUMATIC FCNRVS)
- (11.) THREE WAY CONTROL VALVE
- (12.) RELIEF VALVE
- (13.) DIFFERENTIAL PRESSURE REGULATING VALVE
- (14.) FLOAT OPERATED VALVES

(B.) TANKS AND PRESSURRE VESSELS

- (1.) TANKS (METAL) UPTO 20 M2
- (2.) TANKS (LARGE STORAGE)
- (3.) PRESSURE VESSEL (BELOW 17 BARS)
- (4.) AIR RECEIVER

(C.) PUMPS

- (1.) PUMP LOW PRESSURE CENTRIFUGAL (MOTOR DRIVEN)
- (2.) PUMP UP TO 350 HP (260 KW)
- (3.) PUMP SUMP INSTALLATION

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- (4.) GEAR PUMP/SCREW PUMP
- (D.) PIPE WORK SYSTEM
 - (1.) WATER SERVICES
 - (2.) OIL/FIRE RESISTANT FLUID SYSTEM
 - (3.) AIR SERVICES (COMPRESSOR)
 - (4.) HIGH PRESSURE SERVICES
 - (5.) CONSTANT LOAD SUPPORT
 - (6.) SPRING SUPPORTS
 - (7.) HANGERS AND OTHER SUPPORTS
- (E.) STRAINER AND FILTER
 - (1.) STRAINER/FILTER BASKET TYPE
 - (2.) STRAINER ROTARY (LOW PRESSURE)
 - (3.) FILTER & STRAINERS CENTRIFUGAL SEPARATORS
 - (4.) FILTER & STRAINER Y-TYPE
 - (5.) FILTER & STRAINER (PLATE TYPE)
 - (6.) PURIFIER
 - (7.) FILTER-COMPRESSED AIR LINE
- (F.) HEAT EXCHANGER
 - (1.) HEAT EXCHANGER (GENERAL)
 - (2.) HEAT EXCHANGER-OIL/WATER
- (G.) FANS AND COMPRESSORS
 - (1.) FANS-NON-PRESSURE LUBRICATED
 - (2.) FANS-AXIAL FLOW PRESSURE LUBRICATED
 - (3.) COMPRESSORS-GENERAL
 - (4.) DAMPERS & GATES
- (H.) CRANES AND ELEVATORS
 - (1.) AUXILIARY OVERHEAD CRANE
 - (2.) TRAVEL SUPPORT STRUCTURE FOR CRANE

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- (3.) LONG TRAVEL & CROSS TRAVERSE MOTION OF CRANE
- (4.) MAIN AUX. HOIST MOTION (CRANE)
- (5.) ELECTRIC HOIST
- (I.) POWER TRANSMISSION
 - (1.) POWER TRANSMISSION GEAR BOX
 - (2.) BEARING
 - (3.) FLUID COUPLINGS
- 2. ELECTRICAL**
 - (1.) SWITCHYARD
 - (2.) POWER TRANSFORMERS, LT INDOOR TRANSFORMERS, OUTDOOR TRANSFORMERS,
 - (3.) BATTERY CHARGERS, DC BATTERIES, DG SETS, STATION LIGHTING, OVERHEAD LINES.
 - (4.) MV BUS DUCTS
 - (5.) D.C. MOTOR
 - (6.) HV SQUIRREL CAGE INDUCTION MOTOR
 - (7.) 415 V SQUIRREL CAGE INDUCTION MOTOR
 - (8.) MOTOR OPERATED ACTUATORS
 - (9.) LT SWITCHGEARS/MCC
 - (I.) STANDARD CHECLISTS FOR ALL TYPES OF RELAYS USED IN SWITCHGEARS PROTECTION SYSTEM
 - (II.) PT CARRIAGE AND CUBICLES
 - (III.) CABLE/BUS DUCT/BUS BARS
 - (IV.) CONTRACTOR MODULE
 - (V.) SWITCH FUSE MODULE
 - (VI.) MASTER PANEL OF LUBE OIL PANEL
 - (VII.) FEEDER PANEL OF LUBE OIL PANEL
 - (VIII.) SPACE HEATER AND CABLE MODULE
 - (IX.) CONTROL TRANSFORMER MODULE
 - (X.) HT CIRCUIT BREAKER

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- (XI.) 415 V CIRCUIT BREAKER
- (10.) POWER CABLE
- (11.) CONTROL CABLE
- (12.) AUXILIARY CABLE
- (13.) D.C. CABLE
- (14.) EXPLOSION PROOF ELECTRICAL EQUIPMENT
- (15.) JUNCTION BOX
- (16.) CONTROL TRANSFORMER MODULE
- (17.) BRUSH GEAR ASSEMBLY
- (18.) AUX. CONTROL AND RELAY PANEL DESK
- (19.) INDICATING INSTRUMENT
- (20.) RECORDING INSTRUMENT
- (21.) INTEGRATING INSTRUMENT

3. CONTROL & INSTRUMENTATION

- (A.) CONDUCTIVITY ANALYSING EQUIPMENT INCLUDING TEST PROCEDURES
- (B.) PH ANALYSER INCLUDING TEST PROCEDURE
- (C.) SILICA ANALYSER
- (D.) LEVEL SWITCH (FLOAT ACTUATED)
- (E.) LEVEL SWITCH (ELECTRODE TYPE)
- (F.) LEVEL SWITCH (DISPLACER ACTUATED)
- (G.) TRANSMITTER (FLOAT OPERATED PNEUMATIC OUTPUT) INCLUDING TESTING PROCEDURE
- (H.) LEVEL INDICATOR (FLOAT/PULLEY TYPE)
- (I.) LOCAL TEMPERATURE INDICATORS INCLUDING TEST PROCEDURE
- (J.) RESISTANCE THERMOMETER ELEMENT INCLUDING TEST PROCEDURE
- (K.) THERMOCOUPLE ELEMENT AND CONNECTING CABLE
- (L.) THERMOCOUPLE AND RESISTANCE THERMOMETER CONVERTOR/TRANSMITTER INCLUDING TEST PROCEDURES.

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- (M.) TEMPERATURE SWITCH/THERMOSTAT INCLUDING TEST PROCEDURES
- (N.) COLD JUNCTION BOXES
- (O.) ZENER BARRIER
- (P.) O₂ ANALYSER
- (Q.) O₂ IN HYDROGEN INCLUDING TEST PROCEDURES
- (R.) PRESSURE AND VACUUM GAUGE
- (S.) PRESSURE AND VACUUM SWITCH INCLUDING TEST PROCEDURE
- (T.) DIFFERENTIAL PRESSURE TRANSMITTER INCLUDING TEST PROCEDURE
- (U.) DIFFERENTIAL PRESSURE SWITCH INCLUDING TEST PROCEDURE.
- (V.) FLOW INDICATOR (VARIABLE AREA)
- (W.) ORIFICE PLATE
- (X.) TURBINE FLOW TRANSMITTER
 - (I.) FLOW SWITCH
 - (II.) WEIR
 - (III.) NOZZLE
 - (IV.) FLOW INDICATOR (PNEUMATIC INPUT) INCLUDING TEST PROCEDURE
 - (V.) FLOW INTEGRATOR (PNEUMATIC INPUT) INCLUDING TESTPROCEDURE
 - (VI.) FLOW INDICATOR (FLOAT OPERATED) INCLUDING TEST PROCEDURE
 - (VII.) VENTURI (FLUID)
 - (VIII.) FLOW SWITCH (MAGNETIC TYPE)
 - (IX.) AVERAGING INLET
 - (X.) LIMIT SWITCHES
- (Y.) TURBINE SUPERVISORY MEASURING SYSTEM
- (Z.) POSITION MEASUREMENT AND INDICATION INCLUDING TEST PROCEDURES
- (AA.) TACHOMETER
- (BB.) VIBRATION MEASUREMENT

ERECTION CONDITIONS OF CONTRACT

- (CC.) DIGITAL INDICATOR
- (DD.) MOVING COIL INDICATOR INCLUDING TEST PROCEDURE
- (EE.) RECORDER INCLUDING TEST PROCEDURE
- (FF.) FLAME SCANNER
- (GG.) ELECTRICAL AUTO MANUAL CONTROL STATION
- (HH.) PUSH BUTTON MODULE
- (II.) ALARM ANNUNCIATOR EQUIPMENT INCLUDING TEST PRO
- (JJ.) TEST PROCEDURE FOR ELECTRONIC MODULES OF DDCMIS
- (KK.) THERMO CONTROL VALVE
- (LL.) TEST PROCEDURE FOR ADJUSTMENT OF MODULATING CONTROLLER - PID TERMS
- (MM.) TEST PROCEDURE INDICATING CONTROLLER-ELECTRICAL INPUT AND PNEUMATIC OUTPUT

Note: The items which are not part of this specification may be considered as not applicable.

ERECTION CONDITIONS OF CONTRACT

ANNEXURE-II

BRIEF WRITE UP ON THE CONTENTS OF TESTING SCHEDULE / COMMISSIONING SCHEDULE

Testing Schedules should be designed to ensure that the plant area, equipment or apparatus are tested and commissioned and will operate as per the employer's specifications and good engineering practices.

Testing Schedule/Commissioning Schedule is required to be of a standard format in order to maintain consistency of presentation, content and reporting.

Testing Schedule/Commissioning Schedule should contain the following sections to make the document a self contained one:

1. Plant Details/Design data
2. Testing Objective/Proposals
3. State of the Plant
 - a) Erection Status with respect to Mech. Elect and C&I
 - b) Availability of the services required
 - c) Safety requirements as per Manufacturer's
4. Test method including completion/acceptance criteria
5. Results
6. Appendix
 - a) Testing Programme
 - b) Mech./Elect./C&I -Plant item completing list
 - c) List of Drawing/documents required for carrying out the testing.

ERECTION CONDITIONS OF CONTRACT

ANNEXURE - III

SAFETY PLAN

01. Safety Policy of the Contractor to be enclosed.
02. When was the Safety Policy last reviewed.
03. Details of implementation procedure / methods to implement Safety Policy / Safety Rules.
04. Name, Qualification, experience of Safety Officer
05. Review of Accidents Analysis Method, Methods to ensure Safety and Health.
06. Unit executive responsible to ensure Safety at various levels in work area.
07. List of employees trained in safety employed before execution of the job. Give the details of training.
08. Safety Training Targets, Schedules, methods adopting to providing safety training to all employees.
09. Details of checklist for different jobs / work and responsible person to ensure compliance (copy of checklist to be enclosed).
10. Regular Safety Inspection Methods and Periodicity and list of members to be enclosed.
11. Risk Assessment, Safety Audit by Professional Agencies, Periodicity.
12. Implementation of Recommendations of Audit / Inspections. Procedures for implementation and follow up.
13. Provision for treatment of injured persons at work site.
14. Review of overall safety by top Management and Periodicity.
15. System for Implementation of Statutory legislations.
16. Issue of PPEs to employees, Periodicity / stock on hand etc.

Signature
Head of the Organisation
with date & stamp

ANDAMAN & NICOBAR GAS POWER PROJECT (50MW)

TECHNICAL SPECIFICATION

SECTION – VI

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PART-B
VOLUME – I
CHAPTER – M1
ENGINE AND AUXILIARIES

TECHNICAL REQUIREMENTS

1.00.00 ENGINE COMPONENTS AND INTEGRAL SYSTEMS

1.01.00 GENERAL

Bidders shall offer 4 to 11 nos. identical Gensets with their individual engine generator output and heat rate based on Gas analysis, provided separately in Annexure I, Volume II of Part A of this specification. The combined net plant output of all the generators shall be minimum 45 MW.

Gensets shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine and shall meet the highest safety standards.

1.02.00 ENGINE SYSTEM

1.02.01 The offered engines shall be in conformance to:

- i) Standard: ISO 3046
- ii) Quantity: 4 to 11 nos. identical Engine to meet the plant capacity as specified in clause no. 1.01.00
- iii) Four stroke.
- iv) Proven standard practice of the OEM.
- v) Having an embedded engine control system, controlling the combustion process individually in each cylinder.
- vi) RLNG as base/primary fuel.
- vii) Designed for continuous operation at any load between 30 -100% of power output for the fuel specified.

1.02.02 Lubrication system:

Complete and self-contained lubrication oil system for each Engine shall be provided to supply oil at required temperature and pressure to all Engine bearings. It shall be as per standard proven practice of the Engine OEM for the offered model of Gas Engine.

The lubrication system shall comprise of but not be limited to following:

- i. Wet oil sump
- ii. Engine/Motor driven main lubricating oil pump with pressure regulating valve.
- iii. Pre-lubricating pump with electrical motor or as per standard proven practice of OEM
- iv. Lubricating oil cooler
- v. Lubricating oil temperature controller.

TECHNICAL REQUIREMENTS

- vi. Lubricating oil filter, with integrated safety filter or as per standard proven practice of OEM
- vii. Oil Mist eliminator
- viii. Centrifugal filter or any other arrangement as per standard practice of OEM to maintain the oil parameter as desired for engine's best performance .
- ix. Start-up / running in filters
- x. All necessary piping, valves, specialties, instrumentation and supports

Note: All the piping, fittings, valves, Lube Oil Tanks, and complete strainers including body and element shall be of stainless steel. Further all the parts of lube oil coolers which are coming in contact of lube oil shall be of stainless steel.

1.02.02.00 Purification System

Provide permanently connected, Continuous Oil Purification system having following major equipment / features.

(1) Capacity and purity:

Oil purification system having capacity to purify 20% of total oil charge in system per hour. Purified oil shall have moisture not more than 500 PPM & max. particle size conforming to code 15/12 as per ISO 4406 or requirement of the engine manufacturer whichever is better. The above particle size and moisture content shall be demonstrated with inlet oil quality conforming to 21/18 as per ISO: 4406 and 15000 PPM moisture respectively in one pass.

(2) Type:

Centrifuge or any other type oil purification system as per engine manufacturer's standard practice. All components of the oil purification system including purifier vessel, which are coming in contact with oil shall be constructed from high grade stainless steel.

(3) Purification system shall have following components:

(i) Positive displacement feed & discharge pumps (if required), each having capacity not less than the capacity of the purification system.

(ii) Electric oil heater to heat oil to temperature not more than 65°C with possibility to cut heater elements in steps.

(4) Provision for transferring of oil from one tank to other tank including wet oil sump with or without centrifuge shall be given with necessary valve & piping arrangement.

TECHNICAL REQUIREMENTS

(5) **Type test(s) to be conducted:** Particle size impurities test and moisture test as detailed out in the technical specification, is to be carried out on purification system of engine.

1.02.02.01 Plant Lube Oil Pumps

Following lube oil pumps shall be provided as per the requirements indicated:

- i. 2X100 % capacity pumps of min. 5 m³/hr each for Lube oil unloading from the tankers to storage tank.

Necessary arrangement including unloading hose, valves etc. shall be provided with approach of oil tankers to unloading area.

- ii. 2X100% capacity pumps of min. 5 m³/hr each for transferring lube oil from Lube oil storage tank to the engine.
- iii. 2X100% capacity portable type pumps of min. 5 m³/hr each for evacuation of oil from Engines during overhaul and again transferring back the oil to Engine.

All associated pipes, valves, fittings etc. shall also be supplied by the bidder.

1.02.02.02 Lube Oil Tank

- (i). Following Lube oil tanks of capacity 13kL each shall be provided:

- 1 no. Storage tank
- 1 no. Used/Dirty oil tank

The tank shall be provided with:

- a. 2 x 100% AC motor driven vapor extraction fans
- b. Level indicators for maximum level, minimum level and normal level.
- c. Level transmitters for remote level indication, alarm and protections.
- d. Necessary manholes with covers, platforms, railings, and access ladders.
- e. Drain points, sampling points.

- (ii). Lube oil tanks shall be made from suitable grade of stainless steel plates. The interiors of the tank shall be descaled and coated with a suitable paint/ oil for protection during transportation, which would dissolve with lube oil on first filling of the tank.

- (iii). Oil tank with top mounted equipment shall have sufficient rigidity to prevent sagging and vibration.

- (iv). Equipment attached to the lube oil tank shall be mounted by means of pads and all openings shall be gasketed. Further, openings on the top of the tank shall be raised at least by 25 mm. The tank top shall have adequate draining arrangement.

TECHNICAL REQUIREMENTS

(v). Suctions to pumps mounted on tank shall be from clean compartment of the tank.

All associated pipes, valves, fittings etc. shall also be supplied by the bidder.

1.02.02.03 **Lube Oil Coolers**

Cooling system for Lube oil shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

1.02.02.04 **Filters and Strainers**

(i). For MOP/AOP/Control Oil pump (if applicable) filters, DP Indicator, DP Switch, filling line, drains/ vents fitted with suitable sight glass (as per OEM practice) and proper termination for vent/ drain lines shall be provided as per standard proven practice of the Engine OEM.

(ii). All pumps in the lube oil system shall be provided with stainless steel filter/ strainer at suction (internal).

1.02.02.05 **Oil Piping and Fittings**

Complete piping & fittings shall be provided and following shall be ensured:

- a. Drain pipes have gradual slope towards oil tank.
- b. Pipes carrying hot lube oil are routed so as to avoid cables.

1.02.03 **Ignition system:**

Ignition system shall be of:

- I. With individual controller to:
 - a. Regulate fuel flow
 - b. Regulate air/gas mixture
 - c. Control Ignition timing
 - d. Turning gear system, as applicable
 - e. Starting System: By compressed air injected into the cylinders through starting air valves with protection devices or as per standard practice of OEM.
 - f. Charge air system:
 - g. Embedded Engine control system
- II. RLNG flow meter: Turbine type/ Coriolis type. Output data: Mass flow, Volume flow, Density, Temperature, Totalizer with local display and remote integration with DCS system.

TECHNICAL REQUIREMENTS

1.02.04 Air Intake and Exhaust System

The air intake and exhaust system shall be provided with:

(a) Air intake system:

The offered system shall have proven service record of operation in climatological conditions similar to plant site and shall be capable of operating under most adverse site conditions, without affecting continuous operation of Engine sets and the filtration process. System shall be complete, but not limited to the following:

- i. Intake air Filters
- ii. Intake air silencers – Stainless Steel
- iii. Intake air ducting between Engine and Air filter

(b) Exhaust gas driven turbocharger

(c) Charge air cooler

(d) Rotary oil bath or Dry type charge air filter as per OEM proven practice with silencer

(e) Exhaust gas silencer: Corten steel

(f) Expansion bellows

(g) Rupture discs on exhaust ducting

(h) Necessary exhaust pipe, supports, hangers, expansion joints and insulation

1.02.05 Starting Air System

Type of starting air system used in Engine shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

In case of starting to be done by air, following to be followed:

Min. 2 no. Working+1 no. Stand by starting air compressors of 60Nm³/hr, 30 bar to be provided with Air bottles and with all the piping, valves, instruments etc.

Each Engine shall have dedicated air bottles.

Minimum 1 No. of air bottle shall be provided for each Genset.

The capacity of air bottle(s) for each genset shall be suitably sized for at least 3 starts of one engine at required pressure. Also, provision shall be made for interconnection of air bottles of each genset with the other.

1.02.06 Exhaust stack

The exhaust of each Genset shall be led through separate exhaust air ducting. The ducting shall comprise of necessary fittings, expansion joints, Reactive industrial type silencer, Rain Hoods etc. This ducting shall be routed out of the acoustic enclosure & structurally supported. Vertical run of exhaust ducting shall be as per the statutory requirements of central and local pollution control board. The structural support could be common for more than one vertical run of exhaust of Gensets. The exhaust ducting and supporting structure shall be supplied and installed by the CONTRACTOR complete with all supports, hangers,

TECHNICAL REQUIREMENTS

hardware, expansion joints and insulation with cladding. Bending radius of pipes/ducts should be more than three times of the NB of chosen pipe.

- i) Number: one no. per engine
- ii) Height: As per MOEF&CC /CPCB/A&N administration guidelines.

Stack Height shall be maximum of the following in meter:
 - (a) $H=14Q^{0.3}$, Q= Total SO₂ emission from the plant in kg/hr.
 - (b) Minimum 6m above the building where generator set is installed
 - (c) 30m.
- iii) Construction: Corten Steel
- iv) Insulation and cladding as per following specifications shall be provided on exhaust ducting up to minimum height of 2 m above Engine Hall. Insulation shall be provided conforming to applicable standards and good engineering practices. Further Insulation to be provided to maintain maximum cladding surface temperature of 60°C.
 - a. Insulation shall Light Resin Bonded (LRB) Mattress as per IS8183 at an application density of 120-150 kg/m³. Insulation thickness calculation shall be based on ASTM C-680. Cladding shall be aluminium sheet of 20 SWG.
 - b. Pipes/ducts should be painted before carrying out insulation as per applicable standards. Height of cladding shall be as per standard and confirmed by the CONTRACTOR.

1.02.07 Engine Cooling system

Radiator cooled engine shall be provided. For Radiator cooled engine, the engine cooling system shall be complete, but not limited to the following:

- a) Remote Radiator type with engine/motor driven fan
- b) Frequency convertor for radiator
- c) All necessary piping, valves, specialties, instrumentation and supports
- d) Expansion tanks
- e) Circulating pump along with drive as per standard proven practise of the OEM
- f) Anti-corrosion cartridge
- g) Extra capacity to meet system degradation
- h) Preheating Unit
- i) Maintenance water tank

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1.02.08 Statutory Approval

It shall be responsibility of the Contractor to obtain the necessary approvals of Inspection Authority/Chief Inspector of competent approving Authorities etc. on behalf of the Employer, as may be required for designing and design calculations, manufacturing and erection procedure, testing etc. as called for under the various Regulations. All such documentation submitted to statutory authorities shall also be submitted to the Employer for review. Letter of approval from such agencies/authorities shall also be submitted to the Employer for record purpose.

1.02.09 Limits of NOx Emission

NOx reduction shall be achieved through suitable system by the contractor to limit NOx emission value to the guaranteed conditions as specified elsewhere in the technical specifications and CPCB guidelines.

1.02.10 Noise level

As per standards of MoEF & CC and Central pollution Control Board (CPCB), India Refer Annexure-IA, Volume-IV, Part-A.

1.02.11 Operation and Maintenance platforms

Bidder shall provide access, inspection and maintenance platforms along the engine for facilitating easy access to all the components of the engine e.g., valves, nozzles, C&I instruments etc. during operation and maintenance.

Minimum width of the platforms shall be 1500mm or as per standard proven practice of the OEM to operate and maintain the Gensets without any hindrance or difficulty.

Interconnecting platform between different engine modules also to be provided.

1.03.00 BEARINGS

Bearings used in Engine shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

1.04.00 SEALS

Seals used in Engine shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

1.05.00 COUPLING

Coupling for connecting Engine to generator/Alternator shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

1.06.00 TURNING GEAR SYSTEM

Turning gear system shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

TECHNICAL REQUIREMENTS

1.07.00 GOVERNING SYSTEM

Engine governing system shall be as per standard and proven practice of the Engine OEM for the offered model of Gas Engine.

1.08.00 Oily Water Handling System

The Oily water handling system shall be complete, but not limited to the following:

- i. Oily water collection pits – 2 nos. for collection of drains from Engine Hall
- ii. Vertical sump pumps - Min. 1W + 1S no./ per pit capable of emptying the pit in 15-20 min
- iii. Sludge Storage Tank - 1 no. of adequate capacity (finalized during detail engineering).
- iv. All piping, level switches, level indicators, heat tracers & insulation, if required
- v. Sludge unloading pump unit - 1W + 1S no.

2.00.00 Fuel Gas System

2.00.01 Fuel gas system of each gas engine shall be skid mounted and shall consist of following:

- (i). Last chance filter
- (ii). Stop Valve & Control Valve shall be servo motor actuated or as per OEM standard practice.
- (iii). Distribution piping to the gas burners
- (iv). Flow measuring devices
- (v). Instrumentation required for monitoring of pressure and temperature of gas.

2.00.02 Redundancy level and type of instrumentation in gas supply system shall be the minimum required for safe and reliable operation of the unit.

2.00.03 Fuel gas piping downstream of the individual Absolute Filter Separator unit (not part of Gas Engine Integral System) of each gas engine shall be made of stainless steel of suitable grade.

3.00.00 Starting System

Engine starting system shall be of proven design and as per the standard practice of the manufacturer for the offered model.

3.01.00 Gas Detection System for Combustible Gas & Vapors

3.01.01 Gas detectors shall be provided at strategic locations within Engine Hall and the nearby areas. At least one sensor shall be located in close proximity to each point where leak of combustible gas or vapor is likely to occur. Gas Detection System shall consist of sensor assemblies, controllers, control power supply (with back up arrangement) and dust proof cover assembly for the sensors.

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- 3.01.02 Alarm and protection (Engine trip) shall be provided for gas concentration level exceeding certain set value e.g. alarm for 20% LEL and Engine trip for 60 % LEL (Lower Explosive Limit)
- 3.01.03 Gas Detection System shall be designed to meet NEMA -7 requirements and suitable for Class I, Division II, Group D Area.
- 3.01.04 Sensors of Gas Detection System shall be catalytic diffusion type or any other proven design with flame proof NFPA approved construction. Sensor range shall be 0 – 100 % LEL.

3.02.00 FUEL GAS SUPPLY SYSTEM

3.02.01 Fuel gas supply system shall be capable of providing required quantity of clean, dry gas as acceptable to the Engine fuel gas quality requirements in all operating conditions including the minimum and maximum fuel consumption condition. Fuel gas supply system shall consist of following equipment/ components:

- (i). Emergency Stop Valve at the inlet to isolate the station in case of emergencies (which can be operated remotely from control room).
- (ii). Fuel Gas Heaters, if required.
- (iii). Piping and Valves to make the system complete.
- (iv). Filtration system, if required
- (v). Pressure control valves, if required
- (vi). Gas flow meters (common to all Engines) as well as individual gas flow meter for each Gas Engine as per relevant standards.
- (vii). Required Electrical and C&I Equipment/ Systems.
- (viii). Safety Relief Valves and Gas Vents, if required
- (ix). All drives under this system shall be operated and monitored from Central Control Room.

3.02.02 Gas Flow Meters

- (i). For each Gas Engine, one no. of Gas Flow meter shall be provided to measure the fuel consumption by individual gas Engines. Gas flow meter common to all engines shall also be provided. Location of gas flow meter shall be as per the standard scheme for Gas Engine's integral gaseous fuel system.
- (ii). The type and accuracy of the Gas flow meters shall be as indicated in the relevant chapter of "Control and Instrumentation", Volume-III, Part-B, and Section VI.
- (iii). Design, construction, installation and operation of the Flow Meter shall be in accordance with the relevant Recommendations/ Reports from AGA/ API.

TECHNICAL REQUIREMENTS

3.02.03

Piping and Valves

- (i). All isolation valves in gas system shall be Ball Valves of fire safe design. The trims of all ball valves, safety valves, slam shut off valves and control valves in the fuel gas system shall be made of stainless-steel material of suitable grade.
- (ii). Proper access and operating platforms shall be provided for the operation and maintenance of the equipment/ valves etc.
- (iii). Piping downstream of each of the Absolute Filter Separator unit shall be made of stainless steel of suitable grade.
- (iv). The Fuel Gas supply piping system shall be designed in accordance with the applicable provisions of the latest editions of ASME B 31.1 or B 31.3 and ASME B31.8.
- (v). Welding and stress relieving shall be as per ASME Sec.- VIII, Div. I.
- (vi). Hydro test pressure for piping and components of fuel gas system shall be 1.5 times the design pressure.

3.02.04

All Electricals and Instruments in the Fuel Gas System shall be of Flame Proof/ Explosion Proof Design.

3.02.05

All design documents of the Fuel Gas supply system shall necessarily be reviewed and vetted by the Gas Engine OEM during detailed engineering.

4.00.00

Engine Hall EOT Cranes

Quantity - 2

(i) Rating

(a) Capacity - Each EOT crane (Common for all the engines) capable of lifting 105% of the single heaviest equipment/components (Except Gas Engines) including lifting beam and slings etc. (as applicable) for maintenance and loading/unloading in the engine hall. However, min. 5 Tons capacity of each EOT cranes to be provided

(b) Crane Span – To Suit the span of Engine Hall

(c) Hook level – To suit handling requirement of equipment

(d) Top Rail Elevation – To be confirmed by vendor

(g) Approximate maximum full load speeds

Main Hoist 1.6m/min

Trolley travel 4.0 m/min

Crane travel 8.0 m/min.

(h) Creep speed of hook – 10% of maximum Speed

(i) Creep Speed for cross travel & Long travel - 10% of maximum speed

TECHNICAL REQUIREMENTS

(ii) **Type** – Electrically operated indoor travelling type

(iii) **Applicable Code**

(a) Design and duty of crane structure, main hoist, cross travel, long travel in accordance with class M5 of IS: 3177 (latest edition).

(b) All other structure of cranes in accordance with IS-807.

(c) Hook shank type conforming to IS 15560 (latest edition).

(iv) **Bridge structure**

(a) Vertical deflection caused by safe working load and weight of trolley in central position not to exceed 1/800 of the span.

(b) Trolley stops of spring type to be mounted independently on bridge rails to prevent trolley from running off.

(v) **Buffer**

(a) Suitable buffer to be fitted to each end of carriage assembly and crab.

(b) Buffers to be designed to bring the loaded crane to rest from a speed of 50% of the rated speed.

(vi) **End trucks, wheels and axles To be designed in accordance to IS: 3177 (latest edition)**

(vii) **Bridge and trolley drive Mechanism**

(a) One drive at each end of bridge.

(b) One drive for trolley drive.

(vii) A distinct type alarm with conspicuous warning lights on either side of the crane bridge to indicate overloading of crane.

(viii) Safe means of access shall be provided and to every place of crane where examination/maintenance of any component is involved. A platform shall extend to full length of the crane. The platform shall be made of checkered Steel plate. A double tire handrail of height 1100 mm shall be provided along the outer edge of the platform and 75mm high toe-guards shall be provided all along the platforms and wherever else required from safety

TECHNICAL REQUIREMENTS

consideration. The width of platform shall not be less than 800mm in width and Guard rails shall be provided on the crab side of the bridge platform.

(ix) **LADDERS:** Necessary access ladders shall be provided for access on to crane bridge platform from the gantry girder level, from crane bridge platform to trolley platform and from operating floor of pump to gantry girder level.

(x) Drums To be in accordance with IS-3177 (latest edition).

(xi) Wire Rope

(a) Wire rope of extra flexible plough steel and of 6/36 or 6/37 construction conforming to IS: 2266 (latest edition).

(xii) Bearings and lubrication

(a) The type of bearings for various parts as per IS:3177 (latest).

(b) Bearing life not less than 10,000 working hours.

(c) Centralised grease lubrication with hand operated grease pump for all bearings as per bidder's standard proven practice.

(xiii) Guarding

(a) Suitable guard to push forward or off the rail track any object placed across.

(b) Suitable guards to live electrical wirings downshop lead.

(c) Other guarding as per relevant standard.

(xiv) Safety

(a) To meet the requirements of Factories Act.

(xv) Runway/trolley Rails and rail joints

Rails to be as per relevant Indian Standard and joints to be butt welded by thermit welding or fusion welding.

(xvi) Brakes

2X 100 % Brake shall be provided for each motion. Each brake for hoisting motion, cross travel, long travel etc., shall be designed as per following:

TECHNICAL REQUIREMENTS

Brakes to be as per IS 3177. The Capacity of hoisting motion brakes to be 150% of torque transmitted to the brake drum with full load and that of cross travel and long travel to be 125% of motor rated torque before deaerating.

(xvii) Crane shall be controlled individually for all its motions from the control pendent panel.

(xviii) Crane shall have a permanent inscription of English on each side, readily visible from the ground level, stating the safe working loads in tonnes for the hook, year of manufacture, crane serial number and manufacturer's name.

5.00.00 Factory Acceptance Test (FAT)

Factory Acceptance Test of all the Engines and Alternators shall be attended by the owner/client.

6.00.00 DOCUMENTS TO BE SUBMITTED WITH THE OFFER

6.01.00 In addition to the information required as per Technical Data Sheets, Bidder's offer shall include following information/ documents for gas- Engine as minimum requirement:

- (i). Salient Design Features
- (ii). Constructional Details of the Engine – General Arrangement Drawing, Sectional Drawing, General Description and Material of Construction
- (iii). Scheme and Write-up for Integral Systems of the Engine
- (v). Technical Details and Write-up of Engine Support Systems
- (vi). General Operation Philosophy indicating capabilities and limitations
- (vii). Operation principle, NOx control capability
- (viii). Quality requirements for Fuel, Air and Water
- (ix). Inspection & Maintenance Guideline for Engines
- (x). Performance Curves

6.02.00 Inspection & Maintenance Guideline for the Engine sets shall include following details:

- (a). Identification of major Engine part that require inspection, repairs or replacements during Scheduled Inspection.
- (b). Type of Schedule Inspections for Engine and description of activities/ jobs to be carried out during each type of Scheduled Inspection.
- (d). Design or expected life of major components
- (e). Repair and Refurbishment requirements of major equipment.

TECHNICAL REQUIREMENTS

- (f). Life of Protective Coatings and TBC (Thermal Barrier Coating if provided) for all coated components.
- (g). Shutdown periods required minor inspections and major inspections.
- (h). Extent of disassembly required during each type of Inspection.
- (i). Repair/ replacement criteria for components.
- (k). Manpower (supervisory, skilled, unskilled) requirement for each type of Inspection.

The details furnished shall be consistent with the standard established practice of the Engine model offered and the Bidder may be asked to substantiate the same.

7.00.00 PRE-COMMISSIONING AND COMMISSIONING REQUIREMENTS

Pre-commissioning and Commissioning of Engine shall be as per the standard procedure of Engine. The same shall be submitted to the Employer during detailed engineering for Information. Minimum pre-commissioning and commissioning requirements shall be as specified in following paragraphs.

7.01.00 Pre-commissioning

- 7.01.01 Some of the important Pre-commissioning activities are mentioned hereunder. However, it shall be Contractor's responsibility to draw up a detailed sequential and systematic list of checks / tests connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied under his scope. Procedure for all such checks/ tests shall be submitted to the Employer in course of detailed engineering.
- 7.01.02 Hydraulic test for Fuel Gas system piping and other piping system as per statutory requirement shall also be carried out. All equipment/ T&P required for carrying out these hydro tests shall be arranged by the Contractor.
- 7.01.03 Oil flushing of Lube oil system shall be carried out as part of pre-commissioning. Entire flushing oil requirement and other consumables along with flushing equipment shall be met by the contractor. Further, all temporary connections required for oil flushing e.g., bypass connections for bearings, temporary cooling line connections for lube oil cooler etc. shall be made by the Contractor.
- 7.01.04 After completion of lube oil flushing, the complete system shall be drained and the interior of oil storage tank shall be inspected for cleanliness. The interior surfaces shall be wiped with lint free cloth. Various pipe connections shall be restored for normal operation.
- 7.01.06 Fuel lines shall be cleaned by compressed air blowing after hydro test. Before charging with RLNG, the complete pipe line shall be purged by Nitrogen gas.
- 7.01.07 Exhaust diffuser of Engine shall be visually inspected before the commencement of commissioning activities.

TECHNICAL REQUIREMENTS

7.02.00 Commissioning

7.02.01 Upon completion of pre-commissioning activities/ tests, the Contractor shall initiate commissioning of facilities. During commissioning, the Contractor shall carry out system checks and reliability trials on various parts / systems of the facility. The Contractor shall carry out these checks/ tests to establish that each equipment of the supply complies with the requirements stipulated and are installed in accordance with the provisions of the Technical Specifications. These tests may be conducted concurrently with those required under commissioning sequence. The Commissioning tests/ checks shall specifically include but will not be limited to carrying out necessary commissioning checks for the following:

- a. Operation and Functional Tests for all Integral Auxiliary Systems of the Engine (Lube oil, Turning Gear, Start-up system, Ignition System, Gaseous Fuel Systems, Air Compressor system, Fire Protection & Detection System, Desalination plant, sea water intake pumps, Engine cooling water pumps, service water pumps, potable water pumps, effluent treatment system, Electrical systems, Control and Instrument system etc.).
- b. Air Intake System
- c. Proper working of Interlocks & Protections of all systems.
- d. Electrical tests (for generator, excitation systems etc.).
- e. Synchronization of the Genset unit and load operation.
- f. Maximum Generator Capability - at 0.85 p.f.(Power factor), temperature rise limited to that applicable for class-B insulation as per IEC at 100% rated load condition.
- g. Performance of Emergency DG Set unit(s) at rated load.
- h. Vibration level and parallel operation of following equipment -
 - (i) Sea water intake pumps,
 - (ii) Engine cooling water pumps,
 - (iii) Service water pumps,
 - (iv) Potable water pumps,
 - (iv) De-Salination-RO systems, Effluent treatment system.
- i. Following shall be demonstrated at Site
 - Vibration level of fire water pumps.
 - Performance test of each of systems such as Hydrant, HVW Spray, MVW Spray, Inert gas extinguishing system of control room and control equipment rooms, fire detection and alarm system, Fire extinguishers and Fire monitors as per the design parameters/ standards/TAC.
 - Parallel Operation, vibration & noise level of the fire water pumps and diesel engines.
- j. All tests as required by the TAC/ TAC accredited agency.

TECHNICAL REQUIREMENTS

- 7.02.02 All interlocks and protections of Gensets shall be commissioned and proved through simulation. Employer representative shall be fully involved in all commissioning activities and all records related to control settings shall be entered in commissioning protocols.
- 7.02.03 Functional test for all integral systems shall be completed in all respects during commissioning of the plant.
- 7.02.04 Prior to first ignition in Engine, fire detection & protection system plant shall be commissioned and checked for safe and reliable operation.

TECHNICAL REQUIREMENTS

8.00.00

DATA SHEET:-

Bidder shall fill and furnish following minimum details in the Bid document.

Sr. no.	DESCRIPTION	Units	
1.0	ENGINE		
1.1	Speed	rpm	
	Power Output (Electrical generated power)		
	a. On RLNG	kWe	
1.2	Frequency	Hz	
1.3	No. of Cylinders	Nos.	
1.4	Bore size	mm	
1.5	Swept volume per cylinder	dm ³	
1.6	No. of stroke	Nos.	
1.7	Stroke length	mm	
1.8	Dimensions of Genset	mm	
1.9	Dry Mass	Tons	
1.9a	Operating Mass	Tons	
1.10	Coupling Type	-	
1.11	Starting Method	-	
1.12	Lube Oil consumption		
	a. On RLNG	g/kWhr at full load	
1.13	Lube Oil consumption		
	a. On RLNG	Kg/hr at full load	
1.14	Cooling		
	a. Cylinder Cooling	type	
	b. Charge Air cooling	type	
	c. Fuel injector Cooling	type	
1.15	Start-up time	seconds	
1.16	Start command to full load time	minutes	

TECHNICAL REQUIREMENTS

1.17	Engine shaft driven auxiliaries	-	
1.18	Motor Driven auxiliaries (within engine module)	-	
1.19	NOx emission	In ppm (v/v at 15% excess) Oxygen	
1.20	Coupling details between Engine & Generator	-	
2.0	GENERATOR		
2.1	Dimension	mm	
2.2	Voltage	V	
2.3	Mass	Tons	
2.4	Cooling	type	
3.0	BASE FRAME		
3.1	Type		
3.2	Dimension		
3.3	Fastening/Fixing Type		
3.4	Material		
4.0	Gas System		Details
5.0	Engine Lubrication System		Details
6.0	Lube Oil system facility		Details
7.0	Compressed Air System		Details
8.0	Starting Air System		Details
9.0	Engine Cooling System		Details
10.0	Charge Air System		Details
11.0	Exhaust System		Details
12.0	NOx Control System		Details

PART-B
VOLUME – I
CHAPTER – M2
LAYOUT REQUIREMENT

TECHNICAL REQUIREMENTS

1.00.00 LAYOUT REQUIREMENTS

1.01.00.1 Broad Guidelines for General Layout Plan

General layout plan including indicative/ suggestive Main Plant area for the proposed Gas Power plant is as shown in the tender drawing. It shall form the basis for further elaboration by the Bidder for the plant facilities, which are in his scope. Plant to be installed within the area allocated for the Gas Power plant.

However, Bidder may optimize the space utilization from safe erection, good & safe operation and maintenance aspects.

1.01.02.1 Bidder shall develop detailed layout for the equipment offered in the main plant block considering sequential erection & ease of operation and the same are to be clearly brought out in the bid. Further while preparing the detailed layout, planning the facilities in the Bidder's scope and deciding upon the transportation and construction/ erection strategy and functional requirements, the bidder shall ensure the following aspects:

- a) The area for construction/erection facilities like lay-down, pre-assembly, offices and stores is to be managed by the Bidder. In case bidder requires additional area, he shall make his own arrangement at his cost outside the plant boundary. Development of the same including security etc. for the intended use will also be his responsibility.
- b) Face of the buildings and facilities shall be located in such a way so as to avoid interference of building foundation with road shoulder and drain. The spacing between various buildings and facilities shall be suitably decided so as to avoid interference between their foundations.
- c) All the buildings and facilities shall be approachable by fire tenders.
- d) All statutory requirements including safe distances between various facilities as per applicable rules/acts/laws including local bye-laws shall be met.

1.02.00 Equipment layout

1.02.01 While developing the layout, the Bidder shall ensure following minimum requirements:

1. Number of Maintenance Bays Minimum one (1) no. on one side of Engine hall
2. Utility Block Minimum 2 tier Utility block to be provided
At 1st tier Common Control Room (CCR) and Control Equipment Room (CER) to be provided. PLC/DCS for controlling Electrical breakers shall also be kept in CCR.
2nd tier shall have provision of Inert gas room, Office space, Meeting/Conference Rooms, Store, Pantry room etc.
If Road/Passage way is planned through the Engine hall, min. 8.0m clear headroom below the 1st tier of utility block to be ensured.
3. Arrangement of Gensets Transverse
4. Basement, Pits & Trenches Regular Basement floors are not acceptable in Engine Hall building

TECHNICAL REQUIREMENTS

5. Minimum clear working space around the equipment 1200mm
 6. Minimum width of all Staircase 1200mm
 7. Clear Headroom at different floor Within Engine Hall & Utility Block Below pipes, ducts, structures & Cable trays etc. 2.5m (minimum)
- 1.02.02 Arrangement for the removal/handling of equipment to the maintenance bay to be provided. Further, adequate space and provision for handling/removal of pumps, motors, fans, Switchgear Panels, Transformers and other equipment during maintenance shall be provided with proper approach.
- 1.02.03 For the equipment located outside the Engine Hall building suitable handling arrangement shall be provided by the bidder.
- 1.02.04 All handling arrangements including special arrangements like trolley, trolley drive pedestals etc. for carrying out Inspection/ maintenance of Engine, Generator/Alternator and their auxiliaries shall be provided by the bidder.
- 1.02.05 Inside Engine Hall EOT crane is to be provided which shall be able to travel complete length of Engine hall and passage way envisaged below the Utility Block. Capacity of the Engine Hall EOT Crane shall be as mentioned elsewhere in the specification.
- 1.02.06 In Engine Hall at EOT crane rail level, chequered plate walkway of minimum 500mm clear width from face of the column to the hand rail (excluding hand rail) on crane side to be provided at column sectional depth for full length of the building. Cage ladder shall be provided for reaching the EOT crane operators cabin (if provided) and walkway level.
- 1.02.07 Proper approach shall be provided for access to all equipment during normal operation and maintenance. Unless otherwise specified, platforms, staircases and ladders shall follow the stipulations specified elsewhere in this specification.
- 1.02.08 Equipment requiring monitoring during regular operation shall be approachable from the nearest floor level through staircase. Staircase with minimum width of 1200 mm shall be provided for approach to elevated structures at 5m height from the nearest platform. Below this height a vertical ladder with minimum clear width of 600 mm may also be acceptable.
- 1.02.09 Valves including actuators and instrument tapings shall be located in accessible positions and operating/maintenance platform for the same shall be provided. All piping shall be routed at a clear height of 2500mm (min.) from the nearest access level to clear man movement.
- 1.02.10 Lift landing levels shall be provided for Control Room, Control Equipment Room, and each floor and up to the topmost floor of the Utility Building. Location of Lifts shall be fixed during detail engineering stage while finalizing Plant Layouts. For further technical details refer respective portion of the Technical Specification.
- 1.02.11 (a) All safety requirements as per Factories Act, National Electricity Code etc. shall be complied with while developing the layout.

TECHNICAL REQUIREMENTS

- (b) Switchgear room, Common Control Room, CER and other electrical room/buildings shall be provided with alternate exits in case of fire/accidents as per requirements of Factories Act and TAC. Further, minimum two number fireproof double door shall be provided in Cable vaults and Switch gear rooms.
- 1.02.12 Cable trench/slit requirement shall be provided by bidder as an input drawing for civil works.
- 1.02.13 For the routing of cable trays & piping which includes Fuel oil & gas pipes, Water piping, Fire Protection pipes etc. Bidder to ensure the following-
- I. Gallery and Trestle height in outlying area shall be 3.0 M (headroom).
 - II. Pipe/Cable gallery structure height at road crossings shall be min. 8M (headroom).
 - III. Fire water pipes shall be routed either on trestle or shall be supported from main plant structure or shall be buried wherever not feasible. Wherever oil & gas pipes are running over the trestle, fire water pipes shall not be routed on the same trestle. Further, all other pipes shall be routed over ground either on pedestals or on trestle in plant area. No trenches for pipes shall be envisaged as far as possible. All Road crossing of pipes shall be through heavy duty Hume pipe only.
 - IV. A walkway of 600mm (minimum width) with hand rails & toe guards shall be provided all along length of the gallery and trestle for installation and maintenance of cables. Ladders for approach to these platforms shall be provided near roads, passage ways and turning points.
 - V. Head room for personnel movement shall be 2.1m over the walkways in Pipe/cable trestle galleries for all tiers.
 - VI. Height of trestle galleries at approach roads to various buildings/facilities shall be 8M. In case building are located in off-site area and are adjacent to each other, then as a good engineering practice, the height of trestle shall be maintained all over as 8.0M.
- 1.02.14 **Electrical MCC/switchgear rooms**
1. The following clearances shall be maintained for HT/LT Switchgear.
 - a.) Front Clearance:
 - i) For one Row of Swgr. - 2.0 M (Min)
 - ii) For two Rows of Swgr. - 2.5 M (Min)
 - b.) Back Clearance - 1.5 M (Min.)
 - c.) Side Clearance:
Min. 800 mm, however provision to be made for any additional panel in future at both ends. Therefore, end clearance shall be 800+width of panel (including spare panels/dummy panels etc.)
 2. Height of HT/LT Switchgear Room:
 - i) With Bus Duct - 4.5 m (min)
 - ii) Without Bus Duct - 4.0 m (min)

TECHNICAL REQUIREMENTS

1.02.15 Cable vault shall have 800 mm wide and 2.1 m high movement passage all around the cable trays in the cable vault for easy laying/maintenance of cables. Proper unit wise segregation / separation of cables shall be provided in cable vault area. Switchgear and control panel shall be placed at different elevations.

1.02.16 The transformer yard layout shall be prepared by bidder as an input for civil works. The following layout requirements to be fulfilled while preparation of transformer yard layout.

1. The Transformer fencing shall be at 1.0 M (minimum) distance from the pit wall. The Height of fencing shall be 2.5 M (minimum) and fencing shall have personal entry gate and removable type fencing/gate for transformer withdrawal.
2. For all outdoor transformers a pit shall be provided all around at a distance of 1.0 m (minimum) from transformer outer edge. A sump pit shall be provided for each pit

1.02.17 **DELETED**

1.02.18 **Central Control Room**

All equipment of Air-conditioned Central Control Room housing the system panels, Control desk, OWS, UPS, and Battery etc. shall be provided by the Contractor. Battery shall be located in air ventilated area inside the Control Room. Control Room shall have sufficient free space for movement. Glass partition shall be provided between Central Control Room & Control Equipment Room by the Contractor. The final design of the Control Room shall be finalized during detailed engineering.

The following clearances to be maintained for C&I cabinets:

- | | | | |
|------|---------------------------|---|--------|
| i) | Inter panel spacing | - | 1200mm |
| ii) | Clearance from back wall | - | 1200mm |
| iii) | Clearance from front wall | - | 1200mm |
| iv) | Clearance from side wall | - | 1000mm |

The above clearances are the minimum requirement and may increase with increase in door swing of the cabinets.

The cable laying space below the false flooring in the central control room and control equipment room shall be at least of one meter height. Proper Generator wise segregation / separation of cables shall be provided below false flooring area.

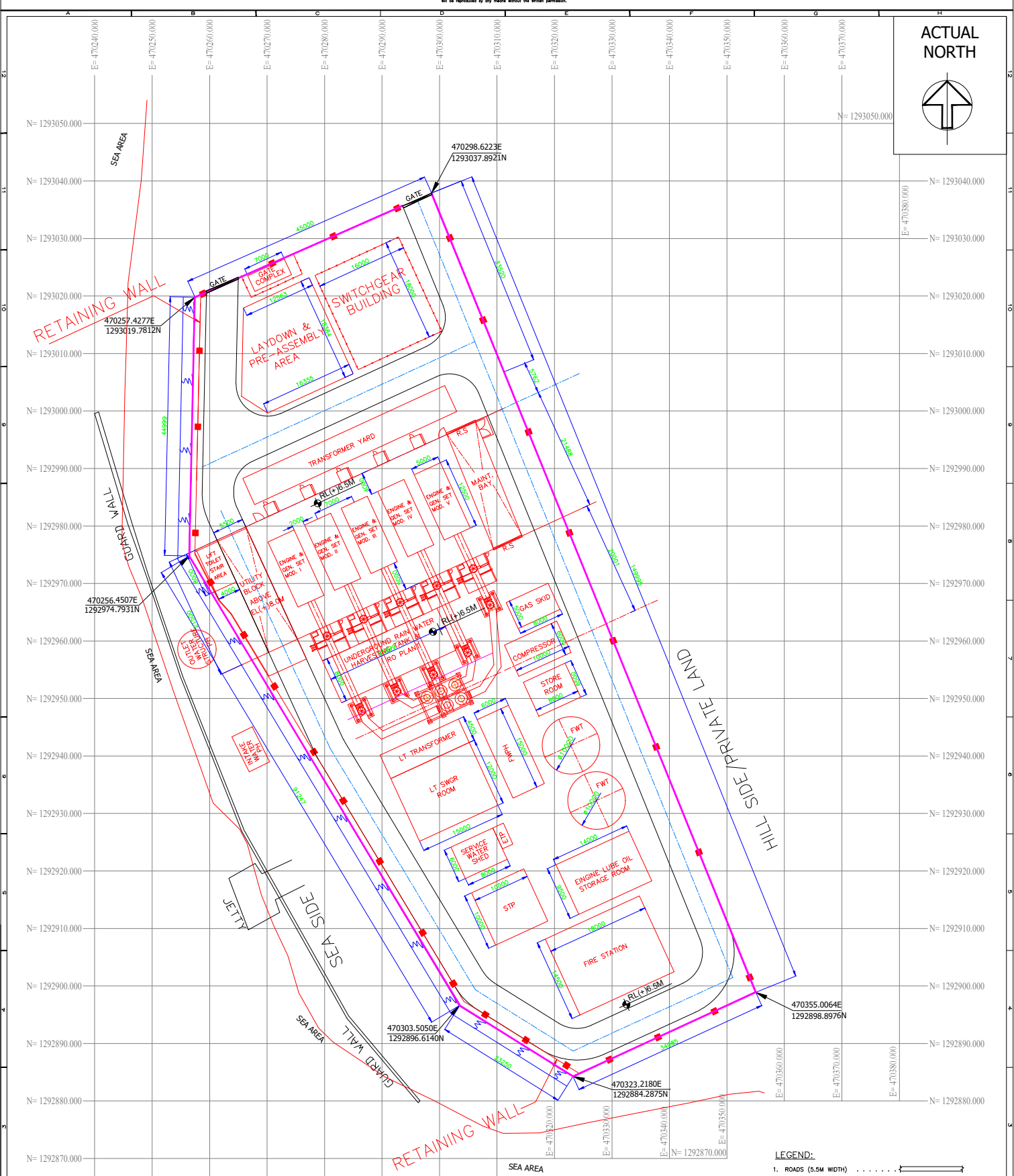
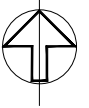
1.03.00 **Storage Rooms for Mandatory Spares and Other Spares for O&M**

Rooms shall be provided in the Utility building and Off-site area for storing mandatory and other spares for O&M. This space shall be in addition to the area for laydown and maintenance requirements specified elsewhere in the Technical Specification.

1.04.00 **Laydown area for maintenance and overhauling:**

- I. The layout of the Engine Hall shall permit sufficient laydown area for all the parts/components to enable carrying out maintenance and overhauling operations without any restrictions and without any hindrance to the operating personnel of other Engine modules.
- II. The Bidder shall furnish general arrangement drawings indicating the equipment lay down area with details such as blocks indicating orientation of dismantled items, travel path etc.

ACTUAL NORTH



- LEGEND:**
- ROADS (5.5M WIDTH)
 - BOUNDARY WALL
 - FENCING
 - FACILITIES/BUILDINGS
 - FORMATION LEVEL
 - LAND ACQUISITION LINE
 - SLOPE LINE

NOTES:

- ALL DIMENSIONS ARE IN MM AND LEVELS ARE IN METRES.
- FOR DETAILS IN MAIN PLANT BLOCK REFER MAIN PLANT LAYOUT DRAWING NO. 6400-999-POM-A-001.
- FORMATION LEVELS FOR THE PROJECT IS (+)RL6.5M.
- TOTAL LAND AVAILABLE IS 2 ACRES.
- GREEN BELT IS NOT CONSIDERED DUE TO SPACE CONSTRAINT.
- PROJECT IS CONSIDERED IN THE CLOSE VICINITY OF THE SEA AND IT IS PRESUMED THAT CRZ CLARENCE FOR THE SAME SHALL BE AVAILABLE IN VIEW OF THE AREA BEING UNDER PORT AUTHORITY.

FOR TENDER PURPOSE ONLY

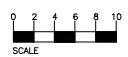
NTPC Limited
 (A GOVT. OF INDIA ENTERPRISE)

PROJECT **ANDAMAN & NICOBAR GAS POWER PROJECT (50MW)**

TITLE **GENERAL LAYOUT PLAN**

NO. **6400-999-POC-F-001**

REV. **2**



REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M.	C.	E.	CAI	APPD.	DATE
2	UPDATED BASED ON INPUT	MANJU	KK	CS						30.11.21
1	REVISION FOR GAS ENGINE PROJECT	MANJU	KK	CS						28.03.20
0	FOR TENDER PURPOSE ONLY	MANJU	KK	RB						14.05.19

PART-B
VOLUME – I
CHAPTER – M3
WATER SYSTEM

WATER SYSTEM

1.00.00 This Chapter describes the technical requirements of water & effluent treatment facilities.

2.00.00 TECHNICAL REQUIREMENTS OF WATER SYSTEM AND ASSOCIATED EQUIPMENTS:

The minimum technical requirements related to the design, manufacturing, testing etc. of the following equipment are furnished below.

- 1) Desalination Plant
- 2) Pumps - Horizontal centrifugal pumps & Vertical Pumps (as applicable).
- 3) Effluent treatment system & Wastewater disposal system
- 4) Piping, valves, fittings

3.00.00 All materials and components of equipments, valves, pumps and piping etc. shall be compatible with sea water/chemical/fluids being handled. All the fasteners like Nuts, Bolts etc. shall be of Duplex stainless-steel material.

4.00.00 DESALINATION PLANT

4.01.00 The Desalination Plant shall be skid mounted. Capacity of UF+RO skid shall be 2X100%. The desalination plant shall consist of Pre-treatment facilities, Ultra filtration, Reverse osmosis (RO) and a Post-treatment facilities (as required). SWRO plant shall be designed to operate for minimum 12 hrs. per day. It shall be provided with all required facilities and systems such as chlorination, antiscalant dosing, degasification (as applicable) etc.

4.03.00 STORAGE TANKS -

S.No	Description	Parameters/Data
1)	Fluid to be Stored	Sea Water /Permeate Water/Service/Potable/UF/Wastewater
2)	Type of Tanks	Horizontal/Vertical Atmospheric
3)	Design Standard	ASME Section-X/ equivalent
4)	Capacity required	As per Equipment sizing criteria
5)	Shell material	FRP
6)	Accessories	<ol style="list-style-type: none">a) Lifting lugsb) Required Nozzles for top fill, vent, overflows, with interior down pipe, Overflow seals, drains, suction, connections for instruments, and flange for mixer /agitators (as applicable),c) Identification labels noting tank designation (150 mm high lettering)d) Staircase & platform (as applicable).e) Manhole, Hand railing on the roof of the tank all around the tank (as applicable).

Note: - Regardless of the theoretical design requirements, the minimum total laminate thickness of the filament wound tank shall not be less than 12 mm.

WATER SYSTEM

5.00.00 PUMPS

5.01.00 GENERAL

5.01.01 The specification covers general requirements in respect of design, material, constructional features, manufacture, inspection, testing the performance at the Vendor's/ Sub-Vendor's works and delivery to site erection, field testing and commissioning of Pumps.

5.01.02 All materials and components of pumps and piping etc. shall be compatible with sea water / respective fluids.

5.01.03 Necessary mechanical supports if required for the pump installation shall also be in vendor's scope of work.

5.02.00 HORIZONTAL CENTRIFUGAL PUMPS

5.02.01 CODES AND STANDARDS

The design, material, construction manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.

5.02.02 List of Applicable Standards

- i) IS : 1520 - Horizontal Centrifugal Pumps for clear cold fresh water.
- ii) IS : 5120 - Technical requirements of rotodynamic special purpose pumps
- iii) API – 610 - Centrifugal pumps for general refinery service.
- iv) IS : 5639 - Pumps Handling Chemicals & corrosion liquids.
- v) IS : 5659 - Pumps for process water
- vi) HIS - Hydraulic Institute Standards; USA
- vii) ASTM-I-165-65 - Standards Methods for Liquid Penetration Inspection.

5.02.03 In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.

6.00.00 DESIGN REQUIREMENTS

6.01.00 The total head capacity curve shall be continuously rising from the operating point towards shut-off without any zone of instability.

6.02.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble-free operation throughout the range. Components of identical pumps shall be interchangeable.

WATER SYSTEM

6.03.00 Pumps shall run smoothly without undue noise and vibration. The measured vibration shall be within the limits specified in Hydraulic Institute Standards.

The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.

6.04.00 Drive Motor (Prime Mover)

6.04.01 The KW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps are specified, the actual motor rating is to be selected considering overloading of the pump in the event of tripping of operating pumps. Continuous motor rating (at 50 deg. ambient) for pump shall be at least 10% above the maximum load demand of the driven equipment in the complete range

7.00.00 TECHNICAL DATA SHEET

SEA WATER APPLICATION		
No	Description	Parameters/ Data
1)	Type of pumps	Horizontal Centrifugal
2)	Type of fluid	Sea water
3)	Design flow (m ³ /hr) rate of each pump	Total flow as required by the downstream applications
4)	Rated Head of pump in MWC	As required
5)	Service Duty	Continuous
6)	Type of pump casing	As per manufacturer's standard
7)	<u>Material of Construction</u>	Note (*): Having PREN (Pitting Resistance Equivalent Number) greater than 40
	a) Casing & Impeller	ASTM 890 Gr 5A / ASTM 995 Gr 5A / ASTM 744 CN3MN or Equivalent (Refer Note * above)
	b) Shaft & Shaft Sleeves	ASTM A 473 S32760 or Equivalent
	c) Mechanical Seal / Gland	ASTM 890 Gr 5A / ASTM 995 Gr 5A / ASTM A 312 S31254 / Equivalent.
	d) Wearing rings	Duplex Stainless Steel
	e) Bolts, nuts etc.	Duplex Stainless Steel

Service water Pumps/ Potable water pumps		
No	Description	Parameters/ Data

WATER SYSTEM

1)	Purpose	Service water /potable water/ process water
2)	Type of pumps	Horizontal Centrifugal
3)	Number of Pumps (Working+ Standby)	Two (2) Nos. (1W + 1S)
4)	Design flow (Cum/hr) rate of each pump	As required.
5)	Rated Head of pump in mWC	As required (Note: Fire water tank shall have a connection from service water pump discharge. Hence, design head of service water pump shall be selected accordingly.)
6)	Service Duty	Continuous
7)	Type of pump casing	As per manufacturer's standard
8)	<u>Material of Construction</u>	Refer sub-section titled "Horizontal Pumps" in Part-B of Technical Specification
	i) Casing	ASTM A CF 8M
	ii) Impeller	ASTM A CF 8M
	iii) Wearing rings (if applicable)	SS -316
	iv) Shaft	SS -410
	v) Shaft sleeves	SS – 410
	vi) Bolts, nuts etc.	Duplex Stainless Steel

8.00.00 VERTICAL PUMPS for Sea Water Intake (as applicable)

8.01.00 CODES AND STANDARDS

8.01.01 The design, material, construction, manufacture, inspection, testing and performance of Vertical Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Standards listed below. Other national standards are acceptable, if they are established to be equal or superior to the listed standards.

8.01.02 List of Applicable Standards

IS: 1710	:	Vertical Turbine Pumps for clear cold fresh water.
IS: 5120	:	Technical requirement of rotor dynamic special purpose pumps.
HIS	:	Hydraulic Institute Standards U.S.A.
PTC 82	:	Centrifugal pumps-power test code

WATER SYSTEM

API 610 : Centrifugal pumps for general refinery purposes.

In case of any contradiction with aforesaid standards and the specifications requirements as specified hereinafter the stipulations of the technical specifications shall prevail.

8.02.00 DESIGN AND PERFORMANCE REQUIREMENTS

- 8.02.01 Pumps of a particular category shall be identical, suitable for parallel operation and provided with interchangeable components. Head vs. capacity and BHP vs. Capacity characteristic should match to ensure even load sharing and trouble free operation throughout the range.
- 8.02.02 The pumps shall have stable Head vs. Capacity characteristic continuously rising towards shut-off with the highest at shut-off and with an approximate shut-off head of 5% or more than the design head for radial flow pumps and 25% more than the design head for mixed flow/ turbine type pumps.
- 8.02.03 The operating range of operation of pumps shall generally be 70% to 120% of rated flow for sustained period of operation.
- 8.02.04 The power requirement of the pump shall be non-over loading type for mixed flow/ turbine type pumps.
- 8.02.05 The critical speed of the pump shall be less than 80% of the rated speed or more than 130% of the rated speed. Also, the critical speed of the pump-motor assembly shall be more than the maximum reverse run-away speed.
- 8.02.06 Pump shall run smoothly without undue noise and vibration. The vibration limit measured at motor DE side shall not exceed the limit specified in Hydraulic Institute Standards. The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.

8.02.07 Motor Rating

Motors shall be selected to suit to the above requirements. Continuous motor rating (at 50°C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation.

Drive motors shall be connected directly to the line shaft of the pump.

9.00.00 MATERIALS OF CONSTRUCTION - Materials of construction of the pumps shall not be inferior to those specified in this sub-section.

1)	Material of Construction (Sea Water application) Note (*): Having PREN (Pitting Resistance Equivalent Number) greater than 40		
a)	Suction Bell	:	ASTM 890 Gr 4A UNSJ92205
b)	Casing	:	ASTM 890 Gr 4A UNSJ92205/ Duplex SS ASTM-A890 CD-4M-CU
c)	Impeller	:	Duplex SS ASTM-A890 CD-4M-CU

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d)	Wearing rings	:	Duplex stainless steel
e)	Impeller Shaft, Pump & line shaft	:	Duplex stainless steel to ASTM A 276 UNS S 31803
f)	Shaft sleeves	:	Duplex stainless steel to ASTM –CD -4M-CU (forged)
g)	Column pipe	:	Duplex SS as per ASTM A 240 UNS S 31803
h)	Discharge Head	:	-do-
i)	Bolts, nuts etc.	:	Duplex Stainless Steel

10.00.00 EFFLUENT TREATMENT SYSTEM - As described in Part-A.

11.00.00 PIPING, VALVES, FITTINGS

11.01.00 Requirements specified here is indicative only. All materials and components of valves, piping and other equipment and appurtenances shall be compatible with the respective water/chemicals.

11.02.00 Piping:

S.No	Service	Material of Construction
1.	Low Pressure Sea Water and Brine from SWRO & RO plant	1) GRP as per ASTM D3517/ AWWA C950/ AWWA M45 or 2) High density polyethylene (HDPE) pipes to ISO 4427:2007
2.	High Pressure Sea Water and Brine from SWRO plant (From discharge of HP Feed pumps of SWRO plant)	High Austenitic Stainless Steel : 1) UNS S31254 as per ASTM A 182/ASTM A 269 (254 SMO)/ASTM A312/ Equivalent - Refer Note * 2) UNS S32750 as per ASTM A 790 / A 182/Equivalent. – (*) Note (*): Having PREN (Pitting Resistance Equivalent Number) greater than 40
3.	Permeate from SWRO Plant	High Austenitic Stainless Steel: 1) UNS S31254 as per ASTM A 182/ASTM A 269 (254 SMO)/ASTM A 312/Equivalent - Refer Note * 2) UNS S32750 as per ASTM A 790 / A 182/Equivalent. – (*) Note (*): Having PREN (Pitting Resistance Equivalent Number) greater than 40
4.	Piping for other usage	As per manufacturer standard practice. However, the same shall be compatible with the respective water/chemical etc. & proven design for intended applications.

11.03.00 Valves

Type of valves in RO skid and valves pertaining to other facilities of water treatment systems shall be as per Manufacturer's standard practice & of proven design for intended applications.

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Further, material of construction for all valve components shall be compatible with the respective water/chemicals etc.

12.00.00 Painting

Painting of all structural steel materials shall be with two coats red oxide primer followed by two coats of chlorinated rubber/epoxy paints as per AWWA D-102 and shall be with due surface preparation/blasting. Minimum DFT shall be 300 microns.

PART-B

VOLUME – I

CHAPTER – M4

FIRE DETECTION AND PROTECTION SYSTEM

TECHNICAL REQUIREMENTS

FIRE PROTECTION AND DETECTION SYSTEM

1.00.00 GENERAL DESCRIPTION

1.01.00 A comprehensive Fire Detection and Protection System covering all the areas of the power plant including various facilities/ system /buildings (if applicable) is included in the scope of the Contract.

1.02.00 The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/ standards / rules of TAC/ NFPA / IS: 3034 / OISD etc.

1.03.00 Fire Water Source

Water for the Fire Protection system shall be drawn from fire water storage tanks to be provided by the Bidder. Water for automatic filling up the fire water storage tanks shall be drawn through fire water transfer pumps & inter intermediate fire water tank. There shall be two sources of water to fill intermediate fire water tank:

- a) service water tanks as primary source.
- b) rain water harvesting tank as second source.

Intermediate fire water tank shall be automatically filled with the help of service water pumps and harvested rain water pumps. Fill in line from above two sources shall be in the scope of vendor. Bidder shall interconnect the same to intermediate fire water tank through individual motorized isolation valve.

1.04.00 Pressurization System

This system consists of two (2) nos. electric motor driven jockey pumps (1 no. working + 1 no. stand-by).

2.00.00 HYDRANT SYSTEM

Hydrant system shall consist of Hydrant pumps, pressurization arrangement, water mains network, hydrant valves, landing valve, isolation gate valves, water monitors, hoses, branch pipes, nozzle, hose boxes, central hose houses etc. Basket Strainer (2x100%) with differential pressure switch and gauge shall be provided in common fire water header at outside FW pump house.

2.01.00 Areas to be Covered

Complete main plant, switchyard, water treatment & radiator area, and other auxiliary buildings / areas under the scope of the Bidder.

3.00.00 HVW AND MVW SPRAY SYSTEM

3.01.00 General

It shall consist of: Spray pumps, pressurization arrangements, water mains network, deluge valves, alarm valves, flow switches, isolation gate valves with limit switches, Y-type strainers, spray nozzles/ projectors, spray nozzles piping network, detection system, instrumentation, local control panels, cables etc.

3.02.00 Areas to be covered by HVW Spray System.

- i) All transformers of rating 10MVA & above.
- ii) Lube oil storage tanks, clean & dirty lube oil tanks, oil coolers and purifier units.
- iii) Feed pump of lube oil system, fuel oil station rack, etc.

3.03.00 Areas to be covered under MVW Spray System

- i) All cable galleries/ cable vault/ cable spreader room in main plant including and switchyard building (if applicable).
- ii) DG set oil tanks.

4.00.00 FIRE EXTINGUISHERS AND FIRE STATION EQUIPMENTS

4.01.00 Fire Extinguishers

As indicated in Bidder's Scope (Refer relevant sub-section, Part A of scope, Section VI).

4.02.00 Fire Station Equipment

TECHNICAL REQUIREMENTS

As indicated in Bidder's Scope (Refer relevant sub-section, Part A of scope, Section VI).

5.00.00 FIRE DETECTION, ALARM AND CONTROL SYSTEM

5.01.00 Codes and Standards

- a. The design, manufacture, testing, performance, etc. of the various components of the analog addressable Fire Detection and Alarm System shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the contractor of this responsibility.
- b. Unless otherwise specified, the Fire Detection and Alarm System and the components shall conform to the latest applicable Indian or IEC Standards. Equipment complying with any other authoritative National Standards such as British, USA, VDE, etc. will also be considered, provided the parameters specified are equivalent or better than the corresponding IS.
- c. The Contractor shall be solely responsible for obtaining the required approval and clearance for the different components and systems of the Fire Detection and Alarm System from the following authorities, as applicable:
 - (i) Department of Atomic Energy (Certification of safety from Radioactivity).
 - (ii) Central Building Research Institute, Roorkee.
 - (iii) Central Mining Research Station, Dhanbad.
 - (iv) Local Fire Authorities.
- d. The equipment and the system shall be of types approved by any of the following bodies, as applicable:
 1. Loss Prevention Council, (LPC), U.K.
 2. National Fire Protection Association, (NFPA), USA
 3. Under-writers laboratories, (UL), USA
 4. Factory mutual (FM)

5.02.00 Areas to be covered under Fire detection and alarm System

- a) **Multisensor type detection system (Above and below the false ceiling or below the false flooring as the case may be)**
 - i) All switchgear / MCC/battery rooms of main plant, Switchyard transformer area/building, various auxiliary buildings like water treatment, pump houses etc.
 - ii) Cable galleries of main plant, switchyard – transformer area, LT switchgear room building protected by MVW spray system. Further, multisensory detectors shall also be provided inside all cubicles/panels of control room, control equipment room and UPS / Battery charger areas.
 - iii) Above and Below false ceiling areas of all air-conditioned rooms of main plant building, various control rooms of auxiliaries as defined in Sl. No. (i) above and return air ducts of inert gas protected areas.
- b) **Linear heat sensing cable detection system**
Cable Galleries covered under MVW Spray System.
- c) **Quartzoid bulb heat detection system**
Area/Equipment protected by HVW & MVW spray system except Cable Galleries/Vault.
- d) For buildings / enclosures with High height Beam Detectors shall be provided for fire detection system.

5.03.00 General requirements for all types of Detectors

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- 5.03.01 Detectors shall be provided with the necessary compression type cable terminating glands for the incoming cables of flameproof type or PVC/metallic flexible/rigid conduits.
- 5.03.02 The detector shall be located where the largest combustion gas concentration can be expected.
- 5.03.03 Adequate compensation and considerations shall be made for effects for wind velocities such as air-conditioning system and exhaust fans where dilution of particles of combustion is greater.
- 5.03.04 The exact location of detectors shall be coordinated with other services like air-conditioning grills, light fittings, cable trays etc. to provide aesthetically pleasing appearance. The return air paths of air-conditioning shall be avoided for detector location.
- 5.03.05 The detectors shall not be affected by temperature, humidity; air flow or by drift failures and shall not give any false alarm due to above.
- 5.03.06 The detectors shall not be sensitive to vibrations. Any special mounting arrangements required to counteract vibration shall be included in the contractor scope.
- 5.03.07 The quantity of multi- sensor detectors in each zone shall be based on the coverage factor of 25-sq. meter per detector. However, the actual quantity of detectors required, taking into consideration obstructions due to floor beams, ventilation, doors, windows etc., shall be worked out and supplied (based on the actual layout) and installed by the contractor.
- 5.03.08 The detectors shall not give false alarm due to high humidity, temperature, and velocity of air in the surroundings and static electricity conditions.
- 5.03.09 Process actuated switch devices such as pressure switches, flow switches, level switches, etc. shall be provided with suitable individual addressable interface (local or remote) units or modules so that these devices are addressable from the panel.

5.05.00 **Linear Heat Sensor Cables**

Application	Detection of Stationary fire
Type	Digital
Operating voltage	24 V DC
Approval	FM/UL
Conductor material	Steel
Insulation	Heat sensitive polymer
Outer Sheath	Black or colored PVC or fluoro polymer suitable for the application environment
Operating Temperature (Alarm)	70 Deg.C for Cable Gallery

Installation features for LHSC detectors

1. The detection zone/loop divisions of LHSC system shall match with MVW spray zones.
2. Linear heat sensing cable detector shall run in a zigzag fashion (with an included angle of 90 deg.) on each top cable tray, bottom tray and every alternate intermediate trays of each section of cable tray without undue sagging and interfering the normal operations. All supporting materials for mounting of LHSC shall be provided by the bidder.

5.06.00 **Addressable Analog Intelligent Detectors**

In addition to the features specified under the item General requirements for all types of Detectors, the Addressable Analog Intelligent Detectors shall be provided with the following features:

TECHNICAL REQUIREMENTS

Detectors not specifically listed for sensitivity testing from the control panel are not acceptable due to the expense involved with manual testing as required by NFPA 72E. Each detector in a loop shall have short circuit isolator suitable for style-7 wiring as per NFPA-72.

The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system.

5.07.00 **Multi sensor Detectors**

5.07.01 Multi sensor detectors shall incorporate a heat detection element and a photoelectric detection element. Both the elements shall be incorporated in a single unit. Both the elements shall be operative at all times and the fire signal shall be available from any or both elements combined together.

5.07.02 The detectors shall be sensitive to very low smoke densities of the order of say 0.05 g/m³. Also it shall be possible to adjust this sensitivity on a step less basis over a range so that the optimum sensitivity could be selected at site to suit the conditions of installations. The coverage area of the smoke detection under standard NFPA test conditions shall not be less than 80-90m².

5.07.03 In areas such as false ceiling where detectors themselves are not easily accessible, the remote response indicators outside the enclosed areas shall be provided to indicate the fire condition.

5.08.00 **System Configuration**

5.08.01 Each of the Addressable Fire Alarm panel shall be able to communicate with one another as well as with repeater annunciation panel and PLC based control panels located at different places. The detectors or other devices of any other unit/area shall be addressable only from the respective Addressable Fire Alarm Panel, so that each of the Addressable Fire Alarm Panel is under the control of designated operating personnel at that location. Facility to operate pumps of booster pump house and fire water pump house shall be provided from PC based monitoring station.

5.08.02 At least one spare loop shall be provided in each of the addressable type fire alarm panel located in control equipment room with complete loop card and all other accessories so that Employer can expand the system in future. Further, at least 10% of loop capacity be left free in each of the connected loop in all the panels, so that, additional devices may be connected to the system in any of the loop by Employer in future.

5.08.03 Fire system (as a whole including PLC control systems) shall be provided with necessary interface hardware and software for dual fibre optic connectivity & interconnection with station wide LAN for two –way transfer of signals for information sharing. The information shall be made available through Ethernet link following TCP/IP standard. The system shall be OPC compliant. All required plant data shall be transferred ensuring complete security. The exact number of points shall be finalized during detailed engineering.

5.09.00 **Analog Addressable Fire Detection and Alarm System**

5.09.01 General Requirements

5.09.02 This specification in general covers the functional requirements, and general design aspects of Microprocessor based, Analog Addressable Fire Detection Alarm / Annunciation and Control System.

5.09.03 The following description intends to describe only the brief hardware and functional requirements, scope of hardware requirements etc. but the actual configuration of the system shall be in line with the prevalent normal practices in the industry and shall conform to latest product range of selected manufacturer.

The fire detection and control system offered shall be complete in all respects for the safe and reliable operation of the entire system. Any additional hardware/software

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than those mentioned herein required to make the system complete shall be included in the scope of the Bidder.

- 5.09.04 Conventional detectors with interface modules are not acceptable. Each zone of LHSC detector and each IR detector shall be provided with interface module.
- 5.09.05 All the fire detection systems, process actuated switch devices such as pressure/flow/temperature switches and relays of control functions shall be hooked up with the analogue addressable fire detection and alarm system. Required addressable interface units shall be provided for various switch devices by the bidder to make them addressable.
- 5.09.06 Bidder shall provide isolators at the start & end of the loop.
- 5.09.07 The complete system shall include, but not be limited to the following:
- a) Master system CPU.
 - b) Analog Addressable Fire Detection and Alarm System panels including alarm modules, system supervisory control modules, auxiliary output control modules etc.
 - c) PC based monitoring station with color graphic display terminal with programming and historical archiving facility along with laser printer.
 - d) Power supplies, batteries and battery chargers.
 - e) Analog addressable type smoke detectors.
 - f) Non addressable type conventional detectors (Linear heat sensing cable detector/ infra red type heat detector) and switching devices each with its own addressable interface modules.
 - g) Software and hardware as required for complete operation of the system.
 - h) Complete Wiring/cabling including its conduits/trays/fixtures etc.

5.10.00 **System Functional Requirements**

- 5.10.01 The fire alarm panel shall evaluate the signals received from the detectors and shall handle the following functions:
1. System self monitoring and fault signaling.
 2. Transmission of alarm and fault signals to the respective fire alarm panels and as well as in the repeater panel in fire station. Further, the panel shall activate a hooter/sounds in each of the area locally provided with fire/smoke detection system. Further, the system shall enable operation of spray system from the panel through monitoring station when the system operation is selected under remote, manual mode.
 3. Initiate control functions like closure of fire doors, shutdown of air-conditioning and ventilation, emergency lighting etc.
 4. Triggering stationary extinguishing systems such as clean agent system.
 5. Supervising of unauthorized removal of a detector head from its base and giving a fault alarm on the control panel.
 6. Supervising and monitoring the detection cabling, to indicate fault conditions in case of open/short circuit in the wiring.
 7. Supervising by a separate annunciation window, changeover from mains supply to battery supply. "Mains On" indication shall be continuously on, as long as the main supply is available.
 8. Facilitating simulation of fire conditions to enable the testing of circuits (without creating actual fire) under the test mode from the fire Alarm panel.
 9. The control unit shall contain all the systems main switches lamps and fuses. Switches and lamps shall be easily identified even in closed casings.

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10. All the circuits from the detectors to the panels and the circuits from panels to the actuating/operating devices of the respective extinguishing system shall be of closed loop type and shall be supervised for open-circuiting and short-circuiting of cables. The cable fault shall be audio-visually annunciated on the panels. Separate hooters with different tones shall be provided for 'fault' alarms and 'fire' alarms.
11. Actuate solenoid valve in spray system in case of fire from respective fire alarm panel. For achieving this if any additional hardware is required like relays, power supply and cables, the same may be provided.

5.10.02

Analog Addressable Fire Detection and Alarm System shall also meet the following functional requirements:

- i. Each of the system shall support analog addressable detectors of all types, non-addressable type detectors/devices along with its addressable interface units/modules, Video display units etc.
- ii. Each of the devices and/or detectors shall be individually, uniquely and continuously addressable by the panel to which it is connected.
- iii. Detectors shall be interrogated for sensitivity settings from the control panel, logged for sensitivity changes indicating the requirement for cleaning and tested by a single technician using the field test routine. Sensitivity of each of the detectors made available in the panel shall be adjustable from the panel.
- iv. The system shall be capable of self-adjustment to compensate for the accumulation of contaminants that would change the detector sensitivity in either a more or less sensitive direction to prevent false indications or failure to alarm in the actual fire conditions. The system shall annunciate a trouble condition when any analog addressable smoke detector reaches 80% of its alarm threshold due to gradual contamination, signaling the need for service and eliminating unwanted alarm.
- v. Continuous supervision/monitoring of all the circuits and its components shall be made available from the panel for open, short circuits and grounding.
- vi. The system shall be able to recognize and indicate an alarm condition in a degraded mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.
- vii. The system shall be programmable at site and required hardware shall be included in the scope of supply. The system software Programs shall be password protected and shall include full upload and download capability. During program upload or download the system shall retain the capability for alarm reporting. The system shall download to a PC for program editing. The software shall be eligible for the employer to add the spare loop provided in the fire alarm panel or addition of additional devices/detectors in and of loop in any of the fire alarm panel.
- viii. The system shall support the use of color interactive History Reporting video display terminal for the display of information in an appropriate format.
- ix. The system shall include software for system database, historical event log, logic and operating system. The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state performing all programmed functions upon power restoration.

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- x. Software logic modules and system database shall be programmable using a windows compatible program on PC. It shall be possible to program or edit the system database off site after down loading from the panel.
- xi. All detectors shall incorporate internal automatic temperature compensation to overcome the effects of either high or low ambient temperatures in the installed environment on the detector sensitivity. The detectors shall be tested at a specified frequency by raising the detector sensitivity level to the alarm threshold, to check the operation of the detector without system alarming automatically by the control panel.
- xii. In an alarm or trouble condition the following shall occur on the monitoring station:
 - 1. Sound an audible.
 - 2. Write details of the actuation to a system log file on the PC.
 - 3. Print the details of the actuation to the system printer.
 - 4. Activate the color graphic display system controls, providing functions such as zooming, scrolling of Alarms, troubles, etc.
- xiii. System configuration shall be menu driven and capable of being operated by a person with no previous computer programming experience.

5.11.00 Panel Display Requirements.

System display shall consist of minimum 80 character back lighted alphanumeric LCD display readable at any angle. Thirty-two character customer defined custom messages shall describe the location of the active device. In addition to the above, the following features shall be available.

- a. The system shall be capable of programming to allow troubles occurred and restored in the system to be automatically removed from the display queue, eliminating the necessity for individual acknowledging of these events. This feature shall not affect the historical logging of events as programmed.
- b. As a minimum an LED display for "Alarm", "Audible Silenced", "Supervisory", "Trouble", "Security", "Power On", And "Partial System Disabled".
- c. Touch activated membrane switches for "Alarm Acknowledge", "Audible Silence", "Supervisory Acknowledge", "Security Acknowledge", "Reset", "Display Hold", And "Display Next".
- d. All membrane switches shall be tactile with audible feedback when pressed.

5.12.00 System Software Requirements

- i) The software shall control the operation, function and display of the graphic system and provide for automatic boot up and run from the hard disk drive of the computer.
- ii) All project specifics actuating device programming shall be capable of being carried out on site via password access.
- iii) The system shall monitor all alarm, supervisory; trouble and security conditions detected by the fire alarm control panel and provide separate disk based files, for each condition. These logs may be enabled, disabled, or cleared with password access.

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This log information is not to be lost upon power failure or fire alarm control panel reset. A utility file shall be provided to sort the log data by date or by device and display this information either on the screen or the system printer.

- iv) Selective memory storage up to 800 events, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports.
 - a. Software shall allow selection of events to be logged, including; inputs as alarms, troubles, supervisors, securities, status changes and device verification; out puts, as audible control and output activation; action, as reset, set sensitivity, arm/disarm, override, password, set time and acknowledge.
 - b. Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 400 events will always be stored in non-volatile memory.
- v) Software has driven logic for adjusting the alarm threshold windows on detectors to compensate for accumulating contamination and keep detector response sensitivity constant. The software shall compensate for either over-sensitized or desensitized units, raising a system flag when a detector approaches the allowable limits of adjustment, indicating a requirement for cleaning.
 - a. Values shall be stored in non-volatile memory allowing activation of all tracking functions within 90 sec of system initiation from a "cold boot". During the boot sequence, alarms from detectors programmed with the feature shall be suppressed.

When the full data history is active all devices shall be checked and any active alarms displayed.
 - b. The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty-four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state.
 - c. The system shall be capable of monitoring the stage of detectors and displaying a message when a detector is approaching the limits of adjustment as a result of contaminates. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminate.
 - d. The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.
- vi) When an alarm or trouble is registered at the fire alarm control panel the graphics system shall display the first screen image for the first actuated device. The system shall be capable of zooming in for further information if required. At all times when in the alarm or trouble mode the fire control panel status i.e. number of current alarms and or troubles is to be displayed on the graphics screen.

5.13.00 **Power Supply for Fire Alarm Panels & Repeater Alarm Panel**

5.13.01 One set of 24V DC redundant power supply system comprising of 2 x 100% chargers and 1 x 100% batteries shall be provided for each fire alarm panel and repeater alarm panel. The batteries for fire alarm system shall be sealed maintenance free lead acid type. The battery backup for each fire alarm panel and repeater alarm panel shall be

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24 hours and 30 minutes (in alarm conditions). At least 25% of the devices shall be considered to be active in alarm conditions. Each of the redundant chargers shall be sized to meet connected load requirements and keep the connected batteries full charged (Float Mode). Furthermore, the charger shall be sized to enable the boost charge of a fully discharged battery in 10 hours while feeding the load.

5.13.02 The batteries shall be sized as per relevant IEEE standard. For battery sizing calculation, an aging factor of 0.8, a temperature correction factor (based on temperature of 4 deg. C), voltage drop of 2V in cables. Capacity factor, Float Correction Factor, as per Battery Supplier Standard, shall be taken into consideration, if applicable and ambient temperature shall be considered as the electrolytic temperature. The sizing of the battery shall be as approved by Employer during detailed engineering.

5.13.03 The battery chargers and batteries shall be placed at a suitable location inside the fire alarm panel with partitions.

5.13.04 The detailed specification related to power supply system of fire detection & protection system shall be as specified in other sections of the technical specification.

5.14.00 **Control & Instrumentation requirements for Fire water pump house.**

The specification related to Basic design criteria, Measuring Instruments, Process connection & piping, Control panels/desk, Type test requirements etc shall be as specified in other sections of the technical specification.

5.14.01 PLC based control panels: The specification for PLC shall be as specified in other sections of the technical specification (vol.-III, Part-B, chapter-IIIC.)

5.14.02 The specification for PC, printer and other HMI items shall be as specified in other sections of the technical specification (vol.-III, Part-B, chapter-IIIC.).

5.14.03 **Power Supply for the PLC system**

24 V DC power supply system for each PLC based control system shall comprise of two sets, each set consisting of the following:

- a) 1x100% microprocessor controlled, intelligent, modular rectifier banks
- b) 1 no. of Controller for each of the above rectifier banks
- c) 1x100% Nickel - Cadmium batteries for one (1) hour duty
- d) 1x100% DC distribution board.

Also 1x100% Microprocessor controlled Battery Health Monitoring System (BHMS) shall be provided as common for both the sets.

The detailed specification of the Battery chargers, Batteries, DCDBs, BHMS etc shall be as specified in other sections of the technical specification.

5.14.04 **Control Cabinets/Panel/Desk**

The detailed specification of the PLC panels, RIO panels, control desk etc shall be as specified in other sections of the technical specification.

5.15.00 **Cabling for fire alarm system**

All instrumentation cables twisted & shielded, FRLS PVC insulated and sheathed data highway / fibre optical cables, short term fire proof cables including prefabricated cables (with plug-in connectors) etc shall be provided by Contractor.

The contractor shall follow the cable philosophy as below:

Application		Type of cable
From	To	

TECHNICAL REQUIREMENTS

PLC cabinets	PC, Printers etc.	As Mfr.'s Standard. However, connection between PLC and the remote I/Os shall be through fibre optic cable by Bidder if length is >300 M & coaxial cable if length <300 M
Detectors (including detectors mounted inside panels) / Any loop device	Detector (including detectors mounted inside panels) / Isolator/ Interface unit	Shielded, Twisted, PVC Cu. FRLS cables type "S" Refer Note 2, 3, 4 and 5 below.
Detectors (including detectors mounted inside panels) / Isolator / Interface Unit	JB	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2, 3, 4 and 5 below.
JB	Fire alarm Panel	Shielded, Twisted, PVC Cu. FRLS cables Type "S" Refer Note 2, 3, 4 and 5 below.

Notes:

1. 10% spare pair shall be provided for all cables having more than four pairs.
2. Type "S" cable shall be multicore control cable having overall shielding & specification similar to instrumentation cable except insulation thickness and voltage grade which shall be 1100 V. Type "S" cable shall also satisfy requirements of Article 760 of NFPA 70.
3. Short term fire proof cable shall be provided for inert gas protected areas. Short term fire proof cables shall be Mineral insulated copper conductor and copper sheathed type satisfying requirements of Fire resistance, safety in the industrial application areas mentioned in the specification and also, shall be approved by UL standards and certified by LPCB. The contractor shall provide all the cables so as to complete the system.
4. Cable size of 2 core 1.5 sq.mm shall be used for loop wiring in-case of both control cable and short term fire proof cable.
5. Cable size of 2 core 2.5 sq.mm shall be used to provide power supply to various devices in the loop in-case of both control cable and short term fire proof cable.
6. The detailed specification of instrumentation cables and optical fiber cable shall be as specified in other sections of the technical specification.
7. Detector cables outside the building shall be corrugated steel taped armoured laid through cable trays wherever available and for rest of the areas, cable shall be buried at 600 mm depth with sand filling and brick covering at the top.
8. Detector cable within the building shall be either unarmoured & laid through galvanized iron (GI) conduits or armoured cables, as per the standard and proven practice of the manufacturer

5.16.00

Detection System of Cable Galleries

- i) In cable galleries, MVW spray system shall be actuated either by detection of fire by Linear Heat sensing cable detectors or by fire signal from Multisensor detection system. Apart from the automatic operation of spray system in the detected zone, the adjacent two zones shall also be sprayed with water automatically after a set time delay simultaneously.
- ii) LHSC detector shall run in a zig-zag fashion (with an included angle of minimum 90° atleast) in each of the top tray, bottom tray and in every alternate trays. The mounting arrangement of LHSC detector shall be as per manufacturer's standard practice.

TECHNICAL REQUIREMENTS

- iii) The detection zone/ loop divisions shall match with MVW spray zones.
- 5.17.00 **Multisensor Detection System**
- i) Upon detection of fire, multisensor detector shall be annunciated in the respective panels and shall activate a local hooter/sounder in the areas where fire is activated and this fire signal shall be employed to initiate the fire extinguishing system of that area such as automatic MVW spray system of cable galleries, fire extinguishing system of Control rooms/Control Equipment Rooms.
- ii) Cross zoning of the signal from two adjacent multisensor detectors shall be employed to initiate the fire extinguishing system of inert gas protected areas and MVW spray system of cable galleries.
- iii) Multisensor detector shall be provided for return air ducts of main plant, which shall consist of intake probe, detector housing, and exhaust pipe etc. The detector shall be mounted outside the duct.
- iv) The design coverage area for detectors (to be considered) shall not exceed 25 Sq.M. for each detector.
- 6.00.00 **INERT GAS EXTINGUISHING SYSTEM**
- 6.01.00 **General**
- a) Fire protection system for the Central control room and other areas as defined below shall be by means of INERT gas extinguishing system. The INERT gas system shall employ any of the proven inert gas system specified under NFPA-2001. System shall be automatic and shall be activated by a dedicated detection system to be provided for each hazard area.
- b) System shall consist of inert gas (as per NFPA-2001) gas cylinders filled with the agent gas, cylinder mounting accessories, cylinder manifold, automatic discharge valves, discharge piping, nozzles, automatic operating devices, manual actuation devices/abort switches, associated fire detection/alarm system audio-visual safety warning devices, instrumentation associated control systems, panels etc.
- 6.02.00 Areas to be covered under Inert Gas Extinguishing System
- a) Central control rooms, control equipment rooms, UPS/Battery charger rooms, programmer room, PADO room, panel room, etc. of main plant building.
- 7.00.00 **FIRE WATER STORAGE, PUMPS & PUMP HOUSE**
- i) Horizontal type centrifugal pumps shall be provided for main fire water pumps and jockey pumps. Maximum speed of the pumps shall be 1500 rpm. However, for jockey pumps the speed up to 3000 rpm is acceptable. The motor driven pump and the corresponding diesel engine driven pump shall completely interchangeable in respect of speed, impeller diameter, etc.
- ii) Capacity, discharge pressure & quantity of pumps common for the hydrant water system and spray water system shall be designed as per Tariff Advisory committee (TAC) guidelines. However, for minimum design requirement please refer **Annexure- II**
- iii) At least one hydrant pump of identical capacity be provided as standby pump so that in case any of the working hydrant pump is not available, the total requirement can be met by the standby pump.
- iv) The standby main fire water pumps shall be of diesel engine driven.
- v) The diesel engine drive of the pump shall conform to the requirements of TAC. Each of the diesel engine shall be provided with batteries (2x100%) and battery chargers (2x100%).
- vi) Battery of the diesel engine shall be lead acid type as per IS and shall be large enough to crank the engine twelve times successively, each for a duration of 10 sec. without any charging in between.

TECHNICAL REQUIREMENTS

- vii) Each engine shall be provided with fuel oil tank having adequate capacity to hold sufficient fuel oil for a minimum of twelve (12) hours of full load run. The fuel oil tank shall preferably be mounted on the engine. No fuel oil tank will be provided by the Employer.
- viii) Continuous drive motor rating (at 50°C ambient) shall be at least 10% (ten percent) above the maximum load demand of the pump in the entire operating range of the pump.
- ix) The feeding line of the hydrant system from the header shall be provided with 2x100% capacity basket type filters to avoid any particles in the system.
- x) The system shall be complete with required instrumentation, control recirculation pipe line with valves for each of the pumps, NRV in discharge outlet etc.
- xi) Pumps shall be designed for continuous operation at its best efficiency point to meet the specific requirements of the system for which it is to be employed. Pumps of each category shall be suitable for parallel operation.
- xii) Fire Water Storage Tanks: Two numbers each of 50% capacity vertical cylindrical column supported fixed cone roof type MS fire water storage tanks shall be provided by the bidder. To avoid vacuum creation inside the tank, two (2) nos. vents each of size min. 150 NB shall be provided on the roof of the tanks. Bidder shall ensure that the total capacity of fire water storage shall be as per the recommendation of TAC with a minimum effective capacity of each tank equal to 500 m³.
- xiii) Intermediate Fire Water Tanks: One (1) number vertical cylindrical column supported fixed cone roof type MS fire water storage tank shall be provided by the bidder. To avoid vacuum creation inside the tank, two (2) nos. vents each of size min. 150 NB shall be provided on the roof of the tanks. Minimum effective capacity of intermediate fire water tank shall be 500 m³.

8.00.00

PIPING AND VALVES

8.01.00

General Data for Pipes etc.

- i) Stainless Steel to ASTM A312, Gr. 316L welded for sizes 65 NB and above. stainless steel to ASTM A312, Gr. 316L sch.40s seamless for sizes 50 NB and below.
- ii) Pipe protection shall be as follows:
To prevent soil corrosion buried pipes / pipes in trench shall be properly lagged with corrosion protective tapes of coal tar type as per IS:15337 or AWWA C 203. The total thickness of protective tapes to be applied on buried pipes / pipes in trench shall be 4.0mm. This can be achieved by using 4.0mm thick tape in single layer or 2.0mm thick tape in double layer.
- iii) All valves Stainless Steel (SS) Gr. 316L shall be as per applicable IS/BS codes and shall be provided with locking arrangement (with locks) in open or close condition. Further, all gate/butterfly valves of size 200 mm & above shall be provided with spur gear reduction unit.
- iv) All the flanges and counter flanges shall conform to ANSI B 16.5 Cl 150.
- v) Strainer Body as per IS:316 (tested).
- vi) Pipe Fittings
 - 1) Stainless steel fittings shall conform to either ASTM-A-182 or ASTM-A-403 Class-S, for sizes upto and including 50 NB, i.e. the fittings shall be of seamless construction. However, for stainless fittings above 50 NB, the same shall conform to ASTM-A-403/ ASTM A-815 Class W i.e. the fittings shall be of welded construction. Further, Fitting material grades shall be compatible with pipe material and dimensional standard conforming to ANSI B 16.11 (socket & threaded type), ANSI B 16.9 (for butt welded fittings) and ANSI B 16.5 (for flanges and flanged fittings) as the case may be.

TECHNICAL REQUIREMENTS

- 2) All materials and products shall be either Underwriters Laboratories (UL) Listed or Factory Mutual (FM) Approved and installed in accordance with NFPA Standard 13 / equivalent Standard.

9.00.00 PAINTING

9.01.00 All the Equipment shall be protected against external corrosion by providing suitable painting.

9.02.00 The Contractor shall clean the tank plates and structure steel before erection by wire brushing and air blowing. After erection of tank and hydro testing, tanks are subjected to surface preparation and painting as per procedure detailed below at **Annexure-I:**

9.03.00 **All Steel Surfaces (external) exposed to atmosphere (outdoor installation)**

- (i) **Surface Preparation:** The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
- (ii) **Painting:** One (1) Coat of epoxy resin based zinc phosphate primer of thickness 30 to 35 microns followed up with three (3) coats epoxy resin based paint pigmented with titanium di-oxide 25 microns as thickness of each coat.

9.04.00 **All Steel Surfaces (external) inside the building (indoor installation)**

- (i) **Surface Preparation:** The steel surfaces to be applied with painting shall be thoroughly cleaned before painting by wire brushing, air blowing, etc.
- (ii) **Painting:** One (1) Coat of epoxy resin based zinc phosphate primer of thickness 30 to 35 microns followed up with three (3) coats epoxy resin based paint pigmented with titanium di-oxide 25 microns as thickness of each coat.

9.05.00 **Inspection and Testing**

All painted surfaces shall be visually checked for uniformity. The dry film thickness of coatings of paint shall be measured.

9.06.00 **Deluge Valves, Water monitors, etc.**

Painting of all equipment/components of FDPS package shall be as per manufacturer's standard practice or as detailed below whichever is superior in quality.

Environment	Paint scheme	Total DFT
Corrosive Environment (as in coastal areas)	Primer- zinc filled epoxy Intermediate – Epoxy MIO Finish – Aliphatic Polyurethane (shade RAL3000)(P.O Red)	Min 200 microns

10.00.00 MULTIPURPOSE NOZZLE

The multipurpose nozzle should be such that water under pressure is applied on fire in the form of a jet, spray or fog. Material of construction for multipurpose nozzle shall be of **SS316** as per manufacturer's standard.

11.00.00 FIRE TENDER AND FIRE STATION EQUIPMENTS

The Fire tender and fire station equipment shall be as per attached **Annexure-III** with Part-B of technical specification.

TECHNICAL REQUIREMENTS

A) SURFACE PREPARATION AND APPLICATION OF PRIMER/PAINT :												Annexure-I
s. n.	description	Surface preparation	Primer coat			Intermediate coat			Intermediate coat			Total DFT (µm)
			Paint	No. of coat	Min. DFT (µm)	Paint	No. of coat	Min. DFT (µm)	Paint	No. of coat (µm)	Min. DFT	
1	Fire water tank (external surface)	SP4*	PS6	1	100	PS12	1	100	PS18	1	120	320
2	Fire water tank (Internal surface)	SP4*	PS6	1	100	-	-	-	PS18	1	120	300
3	Fire water tank- outside surface of bottom plate resting on ground	SP4*	-	-	-	-	-	-	PS21	1	35	35
4	All auxiliary Structural Steel components for pipe supports	SP10	PS7	1	75	PS11	1	100	PS19 PS17	1 1	100 50	325
5	Painting for splash-zone piping external & internal surface (in the vicinity of Sea-Surface experiencing wave-splash off and on)	SP10	PS7	1	70	PS10	2	100	PS17	1	100	370

B) The following surface preparation schemes are envisaged here for surface preparation before application of primer.
 (1) SP4*= Blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron
 (2) SP10= Near white metal blast cleaning with surface profile 35-50 microns as per surface preparation specification SSPC.SP10 of Society of Protective coatings , USA

C) Following are the Primer/painting schemes envisaged herein:
 (1) PS6 = Epoxy based zinc phosphate
 (2) PS7 = Inorganic zinc (ethyl) silicate primer coat
 Self curing Inorganic Zinc (ethyl) Silicate Primer Coat (having minimum 80% of metallic Zinc content in dry film, Solid by Volume Minimum 62% ±2%) to be applied over blast cleaned surface.
 (3) PS10 = Low solvent glass flakes reinforced epoxy, Solid by Volume Minimum 96% ±2%
 (4) PS11 = Micaceous Iron Oxide Epoxy intermediate coat, Polyamide Cured pigmented Micaceous Iron Oxide Epoxy based Paint (containing lamellar MIO minimum 30% on pigment, Solid by Volume Minimum 80% ±2%)
 (5) PS12 = Epoxy based TiO2 pigmented coat
 (6) PS17 = Acrylic Aliphatic Polyurethane, two pack, iso-cyanate based colour pigmented Paint (Solid by Volume Minimum 55% ±2%)
 (7) PS18 = Epoxy based finish coat/ paint
 (8) PS19 = Polyamide Cured colour pigmented Epoxy based Paint (Solid by Volume Minimum 62% ±2%)
 (9) PS21 = Coal tar Epoxy Enamel

TECHNICAL REQUIREMENTS

Technical Data:

1. Fire water pumps	Main Fire Water Pumps (common for hydrant & spray system)	Jockey	Fire Water Transfer Pumps
Number of pumps	2 (1 motor driven & 1 diesel engine driven)	2 (both motors driven)	2 (both motors driven)
Design Capacity	171 m ³ /hr (min) or as per system requirement	10.8 m ³ /hr (min) or as per system requirement	10.5 m ³ /hr (min) or as per system requirement
TDH of pump (MWC)	88 (min) or as per system requirement	88 (min) as per system requirement	as per system requirement
MOC	Casing: ASTM A CF 8M, Impeller: ASTM A CF 8M Impeller shaft, coupling: SS316, wearing ring (if applicable): SS316		
2. Hydrant Valve	Oblique female type as per IS:5290		
	MOC: Body/bonnet/stop valve/valve seat/trim: SS316		
3. Water monitor	As per IS:8442 Type-I, Size: 75mm, Nozzle dia: 38mm		
	MOC: Water barrel/reducer/elbow: SS316 Nozzle: SS confirming to IS:3444 Gr4		
4. Water branch pipe & nozzle	As per IS:903 / IS:2871		
	MOC: Branch pipe: SS316 (Gr 4 of IS:3444) (both ends) Nozzle: SS316 (Gr 4 of IS:3444), Size: min 16mm & max 25mm		
5. Water line Gate/Check Valve	Material of construction (MOC): Body, Bonnet, Disc & Trim: Stainless Steel (SS) 316L/Equivalent Valves shall be of rising spindle type.		
6. Butterfly Valve	Material of construction (MOC): Body, Disc., Shaft & Seat Ring: Stainless Steel (SS) 316L/Equivalent Seal: Nitrile Rubber/EPDM/Neoprene/Equivalent.		

FIRE TENDER AND FIRE STATION EQUIPMENTS

FIRE TENDER AND FIRE STATION EQUIPMENTS:

The scope of equipment to be provided under this specification shall cover all the system and major equipments detailed hereunder. However, for all those items for which details are not covered below relevant IS standard (latest revision) may be referred to.

- 1.0 FIRE WATER TENDER (TYPE-B) FOR FIRE BRIGATE WITH ALL ACCESSORIES**
- 1.1 Fire water tender, Type-B for fire brigade use shall be provided as per IS 950. All accessories listed in IS: 950 shall also be provided with above fire water tender.
- 1.2 The design and construction of water tender shall be in accordance with IS: 950.
- 1.3 The appliance shall incorporate a high and low pressure fire pump of minimum capacity 3000 LPM at 0.7 MPa and 300 LPM at 3.5 MPa capacity in line with IS:950.
- 1.4 The appliance shall carry a water tank of 5000 litres capacity depending upon the type of chassis used. It shall carry an extension ladder and shall be capable of towing trailer pumps.
- 1.5 Gross vehicle weight shall not be less than 25000kg. Maximum speed on level road fully laden, acceleration from standing start through the gear (fully laden) and overall dimension shall be as per IS: 950. The appliance shall be capable of being started from rest on a gradient of 1 to 4.
- 1.6 The choice of material to be used in the construction of the appliance shall be made with a view to combining lightness with strength and durability.
- | | | |
|-------|-------------------------------------|--|
| (i) | Pump casing & low pressure impeller | Lead Tin bronze (grade LTB2 of IS:318) |
| (ii) | High pressure impeller | Phosphor-bronze or stainless steel or aluminum-bronze (IS: 617) |
| (iii) | Impeller ring & impeller neck ring | Lead tin bronze (grade LTB2 of IS:318) |
| (iv) | Pump shaft | Stainless steel (Grade 04Cr18Ni10 of IS:6603) |
| (v) | Pump Panel | Aluminum sheet/ chequered plates (IS: 737) or Mild steel sheet (IS: 513) |
- 1.6.1 All parts which form water ways or come into contact with water shall be of stainless steel.
- 1.7 Design and construction of water tender shall be as per IS: 950.
- 1.8 The tank body and baffles shall be of minimum 5mm thick stainless steel plates.
- 1.9 The tank shall have a bolted manhole of 450mm diameter (min.) and shall have a gun metal threaded ring and cap. of 300mm dia. Of filling the water tank from the top. The manhole cover shall be made from 5mm thick mild steel plates and epoxy coated from inside and outside. A cleaning hole of at least 250mm dia. shall be provided at the bottom.
- 1.10 The design and selection of pump, pump, suction & delivery valves, primer and pipeline & valves etc. shall be in compliance with IS: 950. The pump performance data shall be as per IS: 950.
- 1.11 Hose reels and water/Foam Monitor required shall be as per IS 950.
- 1.12 An electrically operated cable winch of 6 t capacity shall be provided. The winch unit shall be complete with minimum 5.5 HP 12 V dc series wound electric reversible motor for increased pulling power, rope drum, and 27 m heavy duty galvanized EIPS wire rope with replaceable self-locking clevis hook and shall be mounted on the front bumper of the vehicle with suitable strong supports.

TECHNICAL REQUIREMENTS

- 1.13 Telescopic Light Mast or Inflatable Emergency Lighting System shall also be provided as per IS Code.
- 1.14 Tool-Kit Container:-A specially fitted recessed tray for the normal kit of tools, carried on the appliance, shall be provided.
- 1.15 The stability of the appliance shall be such that when under fully equipped and loaded conditions (but excluding crew), if the surface on which the appliance stands is tilted to either side, the point at which overturning occurs is not passed at an angle of 30° from the horizontal.
- 1.16 All parts of the appliance shall be of good workmanship and shall have streamlined finish.
- 1.17 The appliance shall be painted fire red colour conforming to Shade No. 536 of IS 5. The paint shall conform to IS 2932.
- 1.18 Instruction Book, accessories and equipment shall also be provided.

2.0 Not Used.

3.0 FOAM FIRE TENDER WITH ALL ACCESSORIES

GENERAL: The foam fire tender including all accessories shall be designed & manufactured as per the following specifications and sound engineering practice.

All the equipments & accessories shall be fixed on the appliance in a compact & neat manner & so placed that each part is easily & readily accessible for use and maintenance. Foam fire tender with aerodynamic design generally conforming to IS 10460.

3.1 CHASSIS

The chassis shall be suitable with minimum 16 Tons Gross vehicle weight (GVW). The engine fitted on the chassis shall comply with the respective emission norms in force at the time of delivery of chassis. The chassis shall be with the following specifications.

- | | | |
|------|------------|--|
| 1.1 | Engine | Diesel engine developing not less than 150 bhp and conforming to prevalent emission norms. |
| 1.2 | Clutch | Single plate dry friction type hydraulically actuated. |
| 1.3 | Gear | Synchromesh gear box with 6 forward and 1 reverse gear. |
| 1.4 | Front Axle | Heavy duty, forged, 'I' beam. |
| 1.5 | Rear Axle | Single reduction, hypoid gears, fully floating axle shaft. |
| 1.6 | Steering | Integral hydraulic power assisted steering. |
| 1.7 | Brakes | Dual circuit fully air braking system with pneumatically operated brakes on rear wheel. |
| 1.8 | Suspension | semi- elliptical leaf spring at front and rear with hydraulic double acting shock absorber on front. |
| 1.9 | Frame | Ladder type heavy duty frame with riveted 1 bolted cross members. |
| 1.10 | Wheels and | Suitable size available in local market with minimum 16 Tyres PR – 7 Nos. (Including spare wheel) |

TECHNICAL REQUIREMENTS

- 1.11 Fuel Tank Minimum 160 litres capacity.
- 1.12 Electrical System 12/24 volts. 120 Ah capacity battery with Alternator.
- 1.13 Cowl Standard cowl duly painted in RED colour with instrument cluster, rear view mirrors, Wiper system, original driver seat, safety belts.
- 1.14 GVW Not less than 16000 Kgs.
- 1.15 safety features Anti-Lock Breaking System (ABS)

3.2

PUMP:

- 3.2.1 The pump shall be centrifugal type, multi pressure, having output capacity of 3000LPM at 8 kg/cm² and 300 LPM at 35 kg/cm² at 3 mtrs suction lift at NTP condition. The low-pressure side will be of single stage and the high-pressure side also with single stage having regenerative type impeller.
- 3.2.2 The pump shall comply to the following performance parameters.
 - a) Normal Pressure output : 3000 LPM at 8 kg/cm²
 - b) High pressure output : 300 LPM at 35 kg/cm²
 - c) Maximum pressure in : 14 kg/cm² (shut off pressure)
Normal pressure mode.
 - d) Maximum pressure in : 35 kg/cm²
High pressure mode
 - e) Deep lifting capacity of : 30 cm/sec. max. upto 7 Mtrs in
Pump. 30 sec. at NTP condition.
- 3.2.3 The overall pump shall be constructed from gunmetal. The normal (low) pressure impeller, volute, and impeller wearing shall be made from gunmetal conforming to Gr I of IS: 318 and the regenerative type high pressure impeller shall be of Aluminum, Bronze (AB-2). The pump shaft shall be made from stainless steel conforming to IS: 6603. The bearing housing will be made of C.I. and all the studs and bolts coming in contact with water shall be of stainless steel. The bearings used in the pump shall be of reputed make.
- 3.2.4 The normal and high-pressure impeller shall be mounted on a single shaft and normal,(low) pressure impeller shall be dynamically balanced.
- 3.2.5 The pump shall be provided with self-adjusting mechanical carbon seal with interface plate. The mechanical seal assembly shall with stand dry running of pump upto 2minutes without any damages.
- 3.2.6 The pump shall be provided with an inbuilt filter of easily removable type, which shall filter the water before entering into the high-pressure stage impeller.
- 3.2.7 Operation of low pressure to high pressure or vice-a-versa shall be possible by actuation of single lever.
- 3.2.8 The pump shall have facility to operate low pressure and high-pressure mode simultaneously or individually. While high pressure mode is in operation and delivering 300 LPM at 35 kg/cm², the pressure in low pressure side shall not exceed 8.5 kg/cm².
- 3.2.9 The pump shall be provided in built (integrated in the pump outlet manifold) Pressure Relief Valve (PRV) which shall operate automatically and shall not allow the high-pressure to increase beyond 40 kg/cm².
- 3.2.10 The size of high-pressure outlet shall be of 25 mm connected to high-pressure hose reel.
- 3.2.11 The pump shall be provided with one suction inlet of 125 mm dia. having round threads conforming to IS:902 and three numbers of 63 mm delivery outlets having screw down type valves fitted with instantaneous couplings as per IS: 903. The delivery valve spindle sealing shall not be of gland type. The high-pressure outlet shall not be less than 25 mm and shall either be flange or screw type.
- 3.2.12 The efficiency of the pump shall be such that the power and RPM required shall not be more than available with the engine.
- 3.2.13 The pump housing shall have provision to connect to internal cooling system.

TECHNICAL REQUIREMENTS

- 3.2.14 The pump shall be mounted at the rear of the vehicle connected to P.T.O. by propeller shafts and universal and slip joints with sufficient number of bearing supports. All the propeller shafts shall be dynamically balanced and shall be procured from the OEM (the chassis manufacturer).
- 3.2.15 Pump Primer:-The priming system shall be horizontal Reciprocating type or water ring type. The priming shall be fully automatic in operation and shall not require any operation whatever from the pump operator other than throttling the engine to the required RPM. The primer shall get automatically disengaged once the pressure is registered at the pump. The primer shall be capable of lifting the water in 30 seconds from the depth of 7 mtrs. (up to pump inlet) at NTP condition. The pump shall attain a dry vacuum of 620 mm of Hg. The primer shall disengage automatically at a pump pressure of 1.5 to 2.0 kg/cm².
- 3.2.16 In addition Exhaust ejector type primer capable of lifting water from 7 mtrs within 30seconds shall also be provided.
- 3.3 PUMPTEST:** The pump fitted on the vehicle shall be subjected to various tests as detailed below:
- 3.3.1 The pump with its all fitments will be subjected to Hydrostatic testing on a pressure of 21 kgs./cm².
- 3.3.2 The pump shall be run dry for a period of minimum two minutes at 2000 RPM to check the integrity of mechanical carbon seal. After this test there shall not be any leakage of water through carbon seal.
- 3.3.3 The pump performance test will be carried out by running the pump at constant RPM at 2600 and measuring the discharge at various pressure.
- 3.3.4 The pump will be subjected to Endurance test for a period of four hours continuous running. The first Three hours the pump shall deliver rated output of 3000 LPM at 8 kg/cm² and next one hour will be 300 LPM at 35 kg/cm².
- 3.3.5 During the endurance test the water shall not be replenished in the cooling system and the temperature of the cooling water and engine oil should not exceed the manufacturer's standard recommendations for the continuous operation and engine should not show any sign of stresses.
- 3.3.6 Foam induction test to check the calibration of metering valve.
- 3.3.7 Foam production test with monitor and side lines for foam quality.
- 3.4 POWER TAKE OFF:**
The P.T.O shall be Heavy duty type with suitable ratio capable of transmitting the full torque of the engine in first gear. The lever for engaging the P.T.O. shall be provided in the Driver's cabin with proper locking arrangement. The PTO shall be mounted on heavy duty cross members and support brackets between the longitudinal members of the chassis frame. Means shall be provided to check the oil level in the PTO and suitable drain plug shall be provided at the bottom. A cooling coil made of copper tubes shall be provided inside the PTO at the bottom to prevent the oil of the PTO from heating.
- 3.5 WATER TANK -**
The capacity shall not be less than 5000 liters. The tank body and baffles shall be of minimum 5 mm thick SS 316 plates. The sides of the tank shall have Die Pressed reinforced webs for better strength and rigidity. The design of the tank should be such that the complete width of the vehicle is utilized and the height of the tank is to be kept as low as possible for better stability.
- 3.5.1 A tank of required capacity constructed out of mild steel treated for anticorrosion shall be suitably mounted on the chassis in a manner keeping in view the proper load distribution on the axles.
- 3.5.2 A full length runner from behind the driver cabin till end of chassis frame shall be provided and made out of M.S. Channel of 100 x 50 x 5 mm suitably fixed to the chassis, frame with 6mm thick M.S. plate and bolted to chassis frame wherever holes are available in the chassis frame and also with 5/8" 'U' bolts and nuts shall be nylock nuts only.

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- 3.5.3 The tank shall be suitably baffled with minimum 2 nos. of baffles fitted longitudinally and 21 nos. baffles fitted transversely to prevent surge when the vehicle is braking, cornering or accelerating.
- 3.5.4 The baffles shall be arranged in a manner to facilitate the passage of a man throughout the tank for cleaning purpose.
- 3.5.5 The tank shall be mounted on minimum three cross members to counter act the stresses caused by chassis flexion and shall be so secured that it can be easily removed. The water tank shall be provided with six chairs, three on either side for mounting the tank on the runner and chassis frame.
- 3.5.6 The water tank shall be fixed to the chassis frame and runner with 'U' clamps and aluminum packing block and self-locking nuts.
- 3.5.7 Suitable eyes shall be provided on the shell of the tank to enable it to be lifted from the vehicle for repairs / replacement as and when required
- 3.5.8 The tank shall be fitted with a 50 mm bore overflow pipe. Two 63 mm instantaneous hydrant connection, incorporating a strainer with NRV, shall be provided close to the pump control panel for filling the tank through 75 mm bore pipe. Minimum 125 mm bore pipe line shall be taken from the tank to the suction inlet of the pump incorporating minimum 125 mm internal dia. butterfly type valve. Drain valve shall be provided at the bottom of the tank.
- 3.5.9 The MS plates used for the tank shall be Zinc Plated or galvanized and shall be given adequate anti-corrosive treatment of epoxy treatment consisting of one coat of primer with two coats of finish after preparing the surface by sand or shot blasting from inside and outside after fabrication if it is not galvanized. The open end of the overflow pipe should be taken down to a point well below the chassis without affecting the effective ground clearance when fully loaded and shall discharge away from the wheels.
- 3.5.10 Visual -level gauge of the glass / acrylic tube shall be provided at the control panel calibrated 1/4, 1/2, 3/4 and full (preferably calibrated in litres).
- 3.5.11 The tank shall have a bolted manhole of 60 cm dia minimum and should have a gunmetal threaded ring and gun metal cap of 30 cm dia for filling the water tank from the top. The manhole cover shall be made from 5 mm thick M.S. plate and epoxy coated from inside and outside. A cleaning hole of at least 25 cm dia shall also be provided at the bottom.
- 3.5.12 The tank shall be connected with the pump and hose reel and valve(s) shall be provided in such a way that any of the following operations are possible:
- Hydrant -tank,
 - Hydrant - reel,
 - Tank - pump - high and low pressure hose reels,
 - Hydrant - pump - low pressure hose reel, and
 - Tank - Pump - Monitor (Foam water)
- 3.6 FOAM TANK:**
- The foam tank of 500 Ltrs. capacity shall be fabricated out of min. 4mm thick SS plates (304) for bottom & 3mm plates for the sides & baffles. The tank shall be suitably baffled. In addition a 2% of expansion space be made in the tank, over and above foam compound capacity.
- 3.6.1 The cleaning hole of 250mm & drain pipe with a ball valve & plug incorporated in it to be provided. The filler orifice of 150mm dia. with a removable strainer (Material-Resistant to the attack of foam compound) will be provided. The filler cap shall be clearly marked "FOAM".
- 3.6.2 The design of the tank shall incorporate a removable sump fitted with a drain valve. The foam compound draw off tube shall be positioned in the centre of the sump in such a manner that foreign matter or sludge will not pass into the compound line. The draw off tube shall be fitted with a gauge strainer of suitable material, mesh, size & adequate straining area.
- 3.6.3 Means shall be provided for automatic venting of the foam tank when the foam is being produced or the tank is being filled. The device employed shall be as simple as possible & shall not get clogged easily during normal use of the Appliance.

TECHNICAL REQUIREMENTS

- 3.6.4 Inspection hole of 450 mm with cover will be provided. Means shall be provided for automatic venting of the foam compound tank when the foam compound is drawn from it or when the tank is being filled.
- 3.6.5 A foam solution transfer pump Rotary type with necessary piping will be provided. Provision will be made for drawing foam compound direct from an external source through a pick up tube while producing foam.
- 3.6.6 The draw off tube will be connected to the foam proportioner with NRV in addition to the main control valve. The draw off pipe will be fitted with removable strainer.
- 3.6.7 Visual level gauge of the glass/acrylic tube shall be provided at the control panel calibrated 114, 112, 314 and full (preferably calibrated in litres).

3.7 FOAM PROPORTIONER:

Manually operated selector type around the pump foam proportioning system shall be provided at the rear of the pump. The Pump proportioner shall induct foam & water proportionately to feed the foam monitor and hand lines at rate of 6 % plus/minus 0.5% foam. The proportioner shall be calibrated to ensure the correct intake of air foam liquid to foam equipment. This shall have five different position of selector valve i.e.0, 1, 2, 3 & 4.

3.8 DELIVERY OUTLETS:

There shall be 2 Nos. delivery outlets having standard GM inst. female coupling with screw down type delivery valves with blank caps. It should have twist type lugs made of gun metal.

3.9 HIGH PRESSURE HOSE REEL:

Two high pressure hose reel to facilitate operation of the high pressure section of the Fire Pump shall be provided and mounted so as to be accessible for use from either side of the appliance. The hose should be prevented from kinking. The hose shall be light weight PVC nylon braided hose or equivalent and the working pressure of hose will not be less than 40 Kglcm².

The high pressure Hose reels will hold not less than 30 M of hose in one length, terminating in High pressure fog/jet trigger type gun connected by quick connect couplings. The fog gun shall be made of Aluminium alloy or stainless steel (SS 304).

The inlet connection shall have a leak proof rotating type hose connector. The gun shall be of constant flow type with a discharge capacity of 150 LPM approximately. Provision shall be made in the gun controls to achieve combat mode (straight jet) or a fo9 shield in split second. The gun shall have the ability to work on pressure from 20kg/cm² to 40kg/cm² without affecting discharge pattern. The weight of the gun assembly shall not be more than 3 kg.

3.10 WATER/ FOAM MONITOR:

One water cum foam monitor will be provided on the top at suitable location, with cap. of 3000 LPM of water @8.5 Kg/cm². The monitor will be capable of traversing through 360° in horizontal plane, +75deg & -15deg in vertical plane with discharge range of 70 M (water). The detailed specification of the Monitor is as under:

- Size 100 mm
- Body Barrel of SS, GM swivel joint for horizontal & Vertical motion manual operation
- Rotation 360'
- Elevation 90' (+75' -15')

3.10.1 CONSTRUCTION DETAILS

- Working pressure :-7 to 10 kg/cm².
- Painting :- As per IS:5 (2 coats of red epoxy paint)

3.10.2 SELF INDUCTION NOZZLE

- Material of construction Aluminium alloy to IS:617 or

TECHNICAL REQUIREMENTS

GM LTB Gr.2 of IS: 318.

- Type of Foam used AFF Foam
- Discharge capacity 3000 LPM
- Throw horizontal Water: min. 70 mtrs. , Foam: min. 65 mtrs.
- Foam Expansion Min. 1:6
- Fog (curtain) 160°
- K Factor 100.

Semi fog for tank cooling, dissipation of vapour & gases at a distance of 10m & above.

3.11 PIPELINES AND VALVES

- 3.11.1 All pipelines and pipe fittings shall be of Stainless steel (SS 304) and all valves upto 50mm size shall be 3 piece design SS 304 ball valves. All valves above 50mm size shall be standard butterfly valves.
- 3.11.2 All piping shall be sized so as to have minimum pressure drop and achieve the required pressure and flow at various locations.
- 3.11.3 All piping shall be designed for 10% over the maximum pressures encountered in the pipe.
- 3.11.4 The piping shall be flanged for ease of maintenance. However, flange joints shall be kept to minimum.
- 3.11.5 All lines shall be hydraulically tested at 1.5 times of the design pressure and pressure shall be held for two hours. In no case the lines shall be tested below 25 kg/sq. cm. (g).
- 3.11.6 All lines shall be suitably supported so as to provide rigidity and avoid vibrations.
- 3.11.7 All lines less than 50 mm NB size can be socket welded to matching rating fittings.
- 3.11.8 All lines above 50mm NB size shall be butts welded with full penetration welds.
- 3.11.9 All bolts, nuts and washers used shall be of SS-304.

3.11.10 COOLING SYSTEM:

An indirect cooling system of open circuit type heat exchanger shall be provided for cooling the radiator water & Engine. The heat exchanger tank shall be made from minimum 1.22 mm thick brass sheets and the coil in the coolant tank shall be of copper for effective cooling. The design of the heat exchanger shall be such that the temperature of the engine shall not exceed the operating temperature specified by the chassis manufacturer when the vehicle is being used in stationary conditions

3.12 CONTROL PANEL

3.12.1 Adequately illuminated control panel shall be provided near the pump.

3.12.2 The control panel(s) shall include the following:

- a) Throttle control for engine;
- b) Pressure gauge - 0 to 17.5 kgf/cm²; for low pressure (glycerin filled)
Pressure gauge - 0 to 50 kgf/cm²; for high pressure (glycerin filled)
- c) Compound gauge (glycerin filled) calibrated as under:
Vacuum - 0 to 75 cm Hg, preferably in black;
Pressure - 0 to 15 kgf/cm², preferably in black;
- d) Primer control for exhaust primer
- e) Temperature gauge and glow lamp for lubricating system
- f) Cooling water circuit control.
- g) Water tank valve
- h) Foam tank valve
- i) Foam proportioning valve.
- j) Auxiliary foam connection with valve.
- k) Monitor valve
- l) Delivery valves.
- m) Suction inlet.
- n) Hose reel valves.
- o) Water level indicator
- p) Foam level indicator

3.13 BODY WORK AND STOWAGE

TECHNICAL REQUIREMENTS

- 3.13.1** Enclosed accommodation for six persons shall be provided in the driver cab-cum-crew compartment including the driver and in-charge of the crew. Both the seats should be independent. The driver's seat should be adjustable and comfortable. The rear compartment of driver's cabin should have one removable seat for full width of cab for 5 (five) crewmembers. The cab floor should be covered with 3 mm thick Aluminium chequered plate rigidly fixed to the under frame cross members by means of nuts and bolts or riveting except the mudguard arches which shall be covered with 1.60 mm Aluminium chequered plates. Trap doors for topping up oil etc wherever necessary shall be provided.
- 3.13.2** Grand type light should be provided in the driver's cabin dwell vision and external rear view mirrors should be fitted to the cab.
- 3.13.3 The driver cum crew cabin shall be provided with full four doors, one for driver, one for officer and two at the crew compartment. The doors shall be generously sized for easy embarking/disembarking of crew members. All the doors shall be fitted on the super structural members, each hung upon three invisible coach type M.S. stout hinges and fitted with best. Quality handles.
- 3.13.4 The door handle on outside of driver seat shall have a locking arrangement. Other doors shall be lockable from inside. In addition to the doors locks, aluminum tower bolt shall be provided for all the doors from inside Adequate grab rails shall be provided for easily boarding and alighting from the appliance.
- 3.13.5 The windscreen glass shall be provided in the two halves and shall be semi curved type. Each glass shall be fitted in E.P.D.M. rubber beading. The glasses shall be 5 mm thick toughened safety glass.
- 3.13.6 The rubber beading used for fitting glasses and window frame shall be E.P.D.M. rubber.
- 3.13.7 The driver seat shall be adjustable type vertically, forward and backward. The officer seat shall be fixed type. Both the seats shall be rigidly fixed to the flooring by means of nuts and bolts.
- 3.13.8 The seat cushion shall be of latex foam rubber 75 mm thick upholstered in good quality foam leather cloth. The back seat shall be of latex foam rubber 50 mm thick upholstered in good quality foam leather cloth.
- 3.13.9 Below the crew seat, two lockers shall be provided One for battery box and another for keeping accessories. The extra length of battery cable if required shall be provided
- 3.13.10 The crew seat shall be rigidly fixed to floor by means of nuts and bolts, running full width of the vehicle suitable for sitting five fireman, covered with 75 mm x 50 mm cushion latex foam rubber upholstered in good quality foam leather of approved shade.
- 3.13.11 The rear body shall be fabricated in continuation and in line. The under frame cross members shall be fabricated from the rolled M.S. channel of 100 x 50 x 5 mm size.
- 3.13.12 The M.S. runner of 100 x 50 x 5 mm size shall be provided over the full length of the chassis member for the uniform distribution of load over the chassis.
- 3.13.13 Each cross members shall be secured to the chassis frame by 16 mm dia 'U' Bolts with aluminum packing block and self-locking unit.
- 3.13.14 Balata packing of thickness 6 mm shall be provided in between the chassis frame and across members.
- 3.13.15 The structure frame work shall be of welded constructions and made from 2mm thick MS pressed sections and square tubes. The Angles and channels used shall be of min. 3mmthickness. The complete structure material shall be treated for anti-corrosion by Zinc Plating. The plating thickness shall not be less than 20 microns. Two coats of Epoxy paint shall be applied to the completely welded structure. The structure shall be so designed so as to avoid any vibration I rattling I deformation in the intended usage of the vehicle.
- 3.13.16 The details of super structure are as follows:
- a. Under frame cross members :100 x 50 x 5 mm (Min.)
 - b. Floor longitudinal members :50 x 50x 6 mm (Min.)
- The cab and lockers should be of composite construction with sufficient rigidity and reinforcement and shall be kept as light as possible.
 - The interior paneling shall be done from 1.22mm thick aluminium sheets & the exterior paneling shall be done from 1.60mm thick aluminium sheets.

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- The roof on the cabin of the vehicle shall be covered with min. 1.60mm thick aluminium chequered plates. All the lockers sides & complete rear of the vehicle shall be covered with min. 1.22mm thick aluminium chequered plates. The complete rear deck and all lockers floors and the rear foot boards shall be covered with minimum 3mm thick aluminium chequered plate.
- Sufficient number of Lockers with suitable shelves, partitions and roll in roll out type drawers It rays shall be provided on both sides of the vehicle for secure stowage of all equipment given in annexure. One through and through locker shall be provided immediately behind the drivers cab. All space available below the chassis frame level shall be utilized by providing lockers with proper doors. These doors shall be fitted with suitable chains and hooks on both sides so that the same can be used as foot board.
- All lockers shall be provided with internal automatic lighting arrangement with the master switch in the cab.
- All lockers above chassis floor shall be covered with Aluminium roller shutters. The roller shutters shall be made from extruded aluminium sections with suitable roller, spring, guide channels etc. All aluminium sections used shall be properly anodized.
- The Roller shutters shall be rolled inwards underneath the roof giving unobstructed access to the equipment lockers and the firefighting material.
- These roller shutters should open in every position of the vehicle even in rough terrain. Guide rails shall support the shutters over entire length on both sides to make them absolutely torsion free. The roller shutters should have a sturdy lock, preventing accidental opening during movement of vehicle.
- Roller shutters shall be made of hollow rectangular shaped aluminium links which shall be inter connected with rubber /plastic1 PVC profiles sealing the roller shutter watertight when closed. These roller shutters should be durable, maintenance free, weather and corrosion resistant.
- Suitable storage space shall be provided to store four 2.5-m lengths of suction hoses with couplings at convenient location
- SPECIAL PROVISION FOR STOWAGE OF EQUIPMENTS: For all hose fittings like branch pipes etc. quick release type couplings are provided which enables the operator to locate the desired equipment instantly and thereby save valuable time at the time of fire. These couplings also ensure that none of the items damage the internal paneling & thereby increase the life of the vehicle. Suitable clamps, brackets, holders etc. are provided for all other items`

3.14. MISCELLANEOUS

- a. A suitable bumper shall be provided at the rear rigidly fixed to the super structural members by means of nuts and bolts which is supplied along with the chassis.
- b. Two cat ladders made out of S.S. round or square pipe of 25mm dia shall be provided.
- c. 2 nos of 25mm dia aluminum pipe railing with sufficient number of aluminum double socket brackets shall be provided to the rear body over the deck.
- d. A heavy duty Towing hook shall be provided and fitted the rear bumper by means of nuts and bolts.
- e. Quick removable type wire mesh guard made from 25x25mm size MS wire mesh of 1.60 mm covered in MS angle frame shall be provided to all the glasses of driver-cum crew cabin.
- f. CABLE WINCH. An electrically operated cable winch of having capacity of not less than 6.5 tons pulling capacity (single layer) should be provided and mounted in the front of the vehicle. The winch unit should be complete with minimum 5.5 hp, 12v DC series wound electric reversible motor for increased pulling power. The motor and solenoids shall be grounded to the battery. It shall have an automatic load holding brake system for more strength. For free spooling the clutch design shall be easy to use type with spring loaded pull

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and rotate system. The gear system should be 3 stage planetary type for faster line speed and the gear reduction ratio shall not be more than 300:1, the rope drum shall not be of more than 8 inches long having 3.5 inches dia and shall be supplied with minimum,90 ft heavy duty galvanized EIPS wire rope with replaceable self-locking clevis hook and would be mounted on the front bumper of the vehicle with suitable strong supports and a 4 way roller fairlead. The Weight of the winch shall not be more than 55 kgs. Wireless remote for 12 V system or wired remote for 24 v system shall also be supplied with the unit.

g. **TELESCOPIC LIGHT MAST**

A Pneumatic telescopic should be mounted on the vehicle. It should be manufactured from Anodized aluminium 6063 T6 alloy tubes and have a max diameter of 115 mm diameter on its base and complete with a foot plate dia.150 with up to six fixing holes for bolts. The temperature range shall be from -40°C up to 60°C, with anti-twist lock, with safety valve and drainage outlet valve.

The telescopic mast should be extremely strong and designed with a minimum of 6 sections and equipped with a special plastic locking system placed on the ring between the first and the second section meant to eliminate any backlash between all the sections, once the mast is retracted. The mast should be equipped with an internal spiraled electrical cable with 9 wires with a section each of 1.5 mm² and 13 wires with a section each of 0.22 mm², the group of 13 wires should be screened. Each section of the mast should have a thickness of not less than 3.5 mm². For a better movement of the internal cable, the last three internal pistons should be threaded to the corresponding sections. The maximum height of the mast when deployed should be minimum 6000 mm (from the ground), the retracted height should be of maximum 1.900 mm: both heights are meant with the integrated tilt & turn unit. The working pressure should not be less than 2.5 bar and more than 3.5 bar. An electro-pneumatic group of valves must be supplied and mounted at the bottom of the mast with the possibility to regulate the extension speed and the retraction speed separately.

The light mast should have 4 x 1000 Watt Halogen flood light projectors in weatherproof casing. The floodlights on the top should have a minimum electrical rotation of 360° and a tilt of 310°, by means of a tilt and turn unit with an ABS cover for inspection.

A 5 KVA portable Petrol engine operated Gen Set shall be installed at a suitable location in the rear locker and necessary wiring /connections shall be given to the light mast.

3.15 ELECTRICAL SYSTEM:

- 3.15.1 All the important electrical circuits shall have separate fuses suitably indicated and shall be grouped into a common fuse box located at an accessible position. The wiring shall be single pole with negative earth.
- 3.15.2 The suitable size wire shall be selected for different circuits considering the current consumption for that circuit.
- 3.15.3 Electrical siren of 1.6 Kms range 12/24 volts D.C. shall be provided and fitted at suitable place with two controlling push buttons on one officer side and another at Driver side.
- 3.15.4 Two rotating beacon lights with Amber lens shall be provided over the top of driver's cabin.
- 3.15.5 The other lights, pump cabin light, locker lights shall be of approved make.
- 3.15.6 All the controlling switches of lights on dashboard shall be approved make.
- 3.15.7 Two fog lamps of approved make shall be provided and fitted on front-bumper with controlling switch on dashboard.
- 3.15.8 New wiper motor assembly of 17 watts with new blades and arms shall be provided if not provided with the chassis. The location of wiper motor shall be such that it shall be easily accessible for repairs.
- 3.15.9 Adjustable search light assembly shall be provided at a convenient position on the top of rear body deck with 30 mtrs. Cable drum with Rexene cover.

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- 3.15.10 Hooter cum P.A. system shall be provided with a speaker mounted on the top of Driver's cabin with Rexene cover. The output shall be 25 watts.
- 3.15.11 Adjustable spot light, mounted in a convenient position to give flood or beam 04light at the rear of driver cabin shall be provided.

3.16 PAINTING:

- 3.16.1 The complete structure material shall be treated for anti-corrosion by Zinc Plating. The plating thickness shall not be less than 20 microns. Two coats of Epoxy paint shall be applied to the completely welded structure.
- 3.16.2 The complete external and internal aluminum paneling of driver cum crew cabin and rear body shall be painted with two coats of Zinc Chromate paint.
- 3.16.3 The complete exterior of the vehicle shall be painted with two finish coats of "POST OFFICE RED" polyurethane paint of reputed make.
- 3.16.4 The internal painting of cabin lockers etc. shall be done with two coats of Grey Synthetic enamel paint of reputed make.
- 3.16.5 The name of the fire service/organization shall be painted on both sides of vehicle in letter of suitable size in golden yellow paint with black colour shading.
- 3.16.6 The "EMBLEM" of the department shall be painted on both sides of vehicle in natural colours at suitable place.

3.17 LADDER WITH GALLOWS:

An Aluminium extension ladder of trussed type 10.5 mtrs height shall be provided with the vehicle and mounted on suitable ladder gallows. The design of the gallows shall be such that the ladder can be released without difficulty from a reasonably accessible position. Means shall be provided for locking the ladder when stowed

3.18 B.A. SET BRACKETS:

B.A. set brackets for fixing with its fitments shall be provided just behind the crew seat. The mounting of B.A. set bracket shall be such that, it can allow fireman to wear B.A. set while vehicle is approaching to fire call. Proper padding and harnessing arrangement shall be made in the bracket to avoid damages to the critical parts of the BA set.

3.19 ACCESSORIES:

The following accessories shall be provided.

- 3.19.1 Fire Bell: (Bell Carillon): One Gun metal fire bell of 250 mm size conforming to IS: 1928 shall be mounted externally on the top of crew compartment and shall be operated within the crew compartment by firemen in seating position.
- 3.19.2 Six aluminum hooks for keeping the uniform clothing shall be provided in crew compartment.

3.20 WIRELESS SET BOX:

Box made from 2 mm gauge aluminum sheet with lid shall be provided just behind the officer seat with 13mm wooden plank for fitting the wireless set bracket. The design and mounting will be shown at the time of fabrication work.

- 3.21 WORKMANSHIP & FINISH: The GVW of appliance shall not cross the chassis mfgs. Specification with all equipment & Crew. The weight distribution diagram should be submitted for approval. The entire appliance will be painted fire red on the outside. The user name will be written on both-side with yellow colour. Before final painting of Fire Tender two coats of anti-corrosion and primer coat will be applied.

The appliance will clearly have the following markings at suitable locations.

- Manufacturers name and Trade mark.
- Engine and Chassis No.
- Pump No. and capacity of the pump.
- Capacity of Water tank, Foam tank
- All instruments control will be identified with nameplates

3.22 ACCEPTANCE TESTS:

TECHNICAL REQUIREMENTS

The following acceptance tests shall be carried out to the complete satisfaction of the user. The design of vehicle to be such that it shall not affect the Chassis Characteristic as specified by the chassis manufacturer such as speed, turning circle, acceleration, braking distance etc.

The stability of the appliance shall be such that when under fully equipped & laden condition, if the surface on which the appliance stands is tilted to either side, the point at which over turning occurs is not passed at an angle of 27 deg from horizontal. This test should be carried out at the vendor factory in front of all the inspecting officers.

- i) The pump with its all fitments will be subjected to Hydrostatic testing on a pressure of 21 kgs./cm²
- ii) The pump shall be run dry for a period of minimum two minutes at 2000 RPM to check the integrity of mechanical carbon seal. After this test there shall not be any leakage of water through carbon seal.
- iii) The pump will be subjected to Endurance test for a period of Four hours continuous running. The first Three hours the pump shall deliver rated output of 3000 LPM at 8 kg/cm² and next one hour will be 300 LPM at 35 kg/cm².
- iv) During the endurance test the water shall not be replenished in the cooling system and the temperature of the cooling water and engine oil should not exceed the manufacturer's standard recommendations for the continuous operation and engine should not show any sign of stresses.
- v) The other tests shall be as per detailed performance parameters given for chassis, superstructure, firefighting system which include monitor output & throw, foam induction & expansion, load etc.
- vi) Accessories shall also be subjected to relevant tests as per the specification indicated above.
- vii) All accessories and its appendices shall be as per IS: 10460.

4.0 FIRE JEEP WITH TRAILER PUMPS AND WITH ALL ACCESSORIES

Fire Jeep with Trailer pumps and with all accessories shall be provided as per IS: 944. The appendices indicated in the IS code shall also be provided.

4.1

Scope

This standard lays down the requirements regarding material, design and construction, workmanship and finish, and performance tests of 1800-1/min trailer pump for fire brigade use.

4.2

The trailer pump shall consist of a pump of capacity of not less than 1800-1/min at 0.7 MN/m² (7.0 kgf/cm²) pressure, driven by an internal combustion engine. The combined unit being permanently mounted on a trailer with the pump at the rear, and shall be capable of being towed to safety by a standard vehicle.

4.3

Overall Dimension: The overall length of the whole unit shall not exceed 3-3m, the height shall not exceed 1.6 m (with spot light) and the wheel track shall not exceed 1-4 m.

4.4

The design & construction and all material used for the trailer pumps shall fulfil the requirements of IS: 944. Also the accessories mentioned in IS code shall be as per IS code 944.

4.5

The pump shall be of the centrifugal type and so designed as to afford easy access to the impeller. The pump shall be tested for its performance duties stipulated in IS: 944.

4.6

The Trailer frame shall incorporate two semi-elliptic spring and axle. The trailer pumps, Towing eye and Draw Bar shall fulfil the requirements of IS code 944.

4.7

The Instruction book, accessories and equipment etc. and marking, on the Trailer pumps shall be as per IS:-944

5.0 FIRE SUITS

Fire suit shall be provided to as per relevant IS code along with accessories.

Specification of Fire Entry Suit are detailed as under:

5.1

Coat with hood should be sewed fastly together. The hood should have visor with golden reflexive and un-sweaty modification, double protective glass, double fastening metal zip and Velcro being located in to the area of hood.

5.2

The coat should have a provision of wearing a breathing apparatus.

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- 5.3 The trousers should be having regular braces, the belt for marking the waist slimmer in the lower parts of trousers, a metal zip for more comfortable putting up the shoes on the feet.
- 5.4 Leggings: - Steel in lay on the in step, the lower steel support for fastening the shoes and protecting against getting up the leggings.
- 5.5 Gloves: - 05 fingers with membrane against liquid at the wrist with knitting, to use over where over the gloves for protection against heat.
- 5.6 Shoes & Overcoat: - The shoes should have back side double fastening, metal zip and Velcro fastening belt for shoe inside the aluminized overcoat. The entire fire entry suit should be provided with gloves, leggings, shoes overcoat and breathing apparatus pouch. The suit shall have enough space to accommodate inside a self-contained breathing apparatus set in complete protected manner. The weight of total suit should not be more than 08Kgs.

The entire suit should be certified as per EN-1486 standards and should archive level III with the weight not exceeding more than 08Kgs. Shelf life should not be less than 05 years under any circumstances.

Temperature Parameters:- The following temperature parameters should be met by the suit certified by the manufacturer :

- A) The highest direct flame temperature protection should be offered by the suit.
- i) 1500 deg.C to 1800degC for a continuous period of 10 seconds.
- ii) 1400 degC for a continuous period of 30 seconds.
- iii) 1200 deg C for a continuous period of 03 (Three) minutes.
- B) The highest direct radiant temperature protection should be offered by the suit:
- i) 1500 deg. C for a continuous period of 10 seconds.
- ii) 1420 deg. C for a continuous period of 30 seconds.
- iii) 1220 deg. C for a continuous period of 03 (Three) minutes.
- iv) 1200 deg. C for a continuous period of >7 minutes at distance of 1.5 meters from the flame wall. Operations, maintenance, storage and cleaning guidelines along with the catalogues/booklets. Precautions to use the suit and the conditions under which the suit is not be used. Vendor to provide label on his suit as per EN 1486- Level III.

The bidder shall submit the copy of the certificate from the approved certifying agency clearly stating that the suit is meeting all EN 1486 and the vendor is authorized to use the label/mark from the certifying agency (e.g.) or any other reputed International Organization in the regard. Additionally, vendor must also certify the compliance w.r.t. additional specifications given above.

Conformity for the testing shall be required for the following:-

- The aluminized outer fabric (DICKSON 4584) is tested and certified to EN, ISO, EN11612 and EN 1486.
- The moisture & thermal barrier (Dickson 5474) is tested to EN 1486 for moisture and thermal protection.
- The Inner layer (Klopman Gemini FR) is tested and certified to EN ISO 11612.
- The helmet is certified to EN 443.
- The visor is certified to EN 166 & 171.
- The shoe is certified to EN20345 for S1P/HRO.

5.7 PACKING

Suit will be supplied in easy to carry nylon bag.

6.0 CARBON COMPOSITE SELF CONTAINED COMPRESSED AIR OPEN CIRCUIT BREATHING APPARATUS

6.1 SCOPE

This specification prescribes requirements of design, performance and practical test for open circuit type breathing apparatus.

6.2 GENERAL REQUIREMENT

TECHNICAL REQUIREMENTS

- 6.2.1 Self Contained Breathing Apparatus (SCBA), ergonomically designed, light weight glass and carbon filled nylon composite back plate and intrinsically flame retardant 100% Kevlar webbing and 3 padded harness. Cylinder band should be made up of 100% Kevlar. Two stage pneumatic system comprising positive pressure demand valve with hands free bypass facility, vision 3 face masks with more than 85% field vision and scratch resistance polycarbonate visor should be provided. Warning whistle should have an operating pressure of 55 bars. First stage pressure reducer with single high pressure cylinder connector with steel braided hose. The Apparatus is to be supplied with CCE approved 6/6.8 ltrs, 300 Bar High pressure carbon composite cylinder (duration - 45/46 Mins).
- 6.2.2 The unit is to be provided as attached with automatic distress signal unit capable of giving analogue and digital reading of the pressure.
- 6.2.3 Low pressure alarm and ADSU featuring a motion sensor which gives alarm if the user is motionless for 30 seconds.
- 6.2.4 The BA set has to be CE approved, as per EN137 Class-II 2006 Standard.
- 6.2.5 The compressed air breathing apparatus shall be so designed so that the wearer can breathe comfortably, without any risk of poisonous gases entering the breathing circuit. The breathing circuit should be so designed so that there is optimum utilization of compressed air stored in the cylinder during Fire Fighting and rescue operations. The set as a whole shall be so designed so that the handling of the set is easy and does not cause any damage to the set. Set shall be capable of being used with cylinders having working pressure up to 300 bars at least. The BA set should have no air losses. No toxic matter can enter the mask back plate should be ergonomically designed for comfort and stability and there should have provision of connection between wearers.
- 6.2.2. **MATERIAL**
- 6.2.2.1 All the materials used in the construction shall have adequate mechanical strength, durability and resistance to deterioration by heat or by contact with seawater or plain water. Such materials shall be antistatic and fire resistant as far as practicable.
- 6.2.2.2 Exposed parts excluding cylinders, that is, those, which may be subject to impact during practical performance tests, shall not be made of magnesium, titanium, aluminum or alloys containing such proportions of these metals which on impact give rise to frictional sparks capable of igniting flammable gas mixtures.
- 6.2.2.3 Materials that may come into contact with the skin shall be non-staining soft, pliable and shall not contain dermatitis substances.
- 6.2.2.4 The apparatus shall be sufficiently robusted to withstand the rough usage; it is likely to receive in service and designed so that it will continue to function satisfactorily while temporarily accidentally submerged in water at a maximum depth of one meter and thereafter until the air in the cylinder is exhausted.
- 6.2.3 **SEPARATION OF PARTS**
- The design and construction of the apparatus shall permit its components parts to be readily separated for cleaning, Examination and testing. The couplings required to achieve this shall be readily connected and secured, where possibly by hand, and means for sealing used shall be retained in position when the joints and couplings are disconnected during normal maintenance.
- 6.2.4 **ADJUSTABLE PARTS**
- All parts requiring manipulation by wearer shall be readily accessible and easily distinguishable from one another by touch. All adjustable parts and controls shall be so constructed that their adjustment is not liable to accidental alteration during use
- 5.1.1 **WEIGHT**
- The weight of the apparatus shall not exceed 09 Kg. The cylinder used for compressed air should have the approval of Chief Controller of Explosive.
- 6.2.6 **LEAK TIGHTNESS**
- The apparatus shall be of positive pressure type so as to prevent ingress of the external atmosphere. There should be not leakage from any joint.
- 6.2.7 Airline connection and second user connection and inlet-cum-outlet shall be provided on the pressure reducer for attaching, airline connection for second user connection.
- 6.3 **FACE MASK**

TECHNICAL REQUIREMENTS

- 6.3.1 The face mask should be made either of Neoprene or Silicone. The air inlet valve should connect to the mask by simply clipping it on the enable wearer to switch on the positive pressure at the last minute.
- 6.3.2 Face mask shall cover the eyes, nose, mouth and chin, it shall be provided with an additional flap for providing adequate sealing on the face of the wearer of the breathing apparatus against the outside gas, when the skin is drying or moist, when the head is moving and when the water is peaking.
- 6.3.3 The face mask shall have an inner mask to reduce misting and dead space so that the mask is always remain at center.
- 6.3.4 Face mask shall be secured to the face by means of an adjustable./replaceable head harness and they shall be fitted with a neck strap to support them when not being worn. There shall be five head harness but one strap i.e. the top one should
- 6.3.5 Means for speech transmission shall be incorporated and so designed that it is in front of the mouth.
- 6.3.6 The face mask shall be constructed of silicon rubber in order that it is soft, light in weight, comfortable to the wearer to wear for long duration, resistant to chemicals and heat, thus having longer life.
- 6.3.7 The connection for demand valve shall be provided in front of the Face Mask.
- 6.3.8 The visor shall be made of clear polycarbonate.
- 6.4 **FACE CONNECTOR**
The connection between the face mask and the demand valve shall be of Clickon/Push fit type well secured so that, the set is having fully automatic positive pressure, there is optimum utilization of compressed air stores in the cylinder and the mask by mistake is not used with a filter canister.
- 6.5 **HEAD HARNESS**
The head harness shall hold the face mask firmly and comfortably in position. It shall be molded from silicon rubber. It should be easily detachable for cleaning and decontamination. There shall be five quick release harnesses out of which only 4 shall need to be tightening with the 5th i.e. top one shall be prefixed to ensure quick donning and center placing of the mask while wearing.
- 6.6 **BODY HARNESS**
The body harness shall be designed to allow the user to done the apparatus quickly and easily without assistance and shall be adjustable for fit. Buckles fitted to waist and shoulder harness shall be so constructed that once adjusted they will not slip.
- 6.7 **EXHALATION VALVE**
The apparatus shall be provided with a unidirectional exhalation valve spring loaded to maintain positive pressure in the face mask. The resistance of the valve should not exceed 6 millibars, it shall be protected against dirt and mechanical damage.
- 6.8 **DEMAND VALVE**
It shall be fully automatic positive type. Designed to provide a flow rate of at least 50 ltrs /min at all cylinder pressure above 20 bar. It shall be designed to push fit/click on to the mask.
- 6.9 **SUPPLEMENTARY SUPPLY**
The apparatus shall be provided with a manually operated push type means on the demand valve itself for supplementary supply.
- 6.10 **HIGH PRESSURE TUBE**
It shall be having outer covering of neoprene rubber. The test pressure of the tube shall be above 600 bar. It shall be fitted to the set in a manner that it cannot be separated by hand. The entire high pressure tube shall be covered by a medium pressure tube having medium pressure supply for safety reasons.
- 6.11 **MEDIUM PRESSURE TUBE.**
It shall be having outer covering of neoprene rubber. The test pressure of the tube shall be above 20 bar. It shall be so designed that it can be separated by hand and cannot be fitted at the joints where High Pressure Tube is fitted.
- 6.12 **PRESSURE GAUGE**
- 6.12.1 It shall indicate pressure on opening of the cylinder. The range shall be 0-350 bar. It shall be placed that the wearer can easily see the pressure while using the set.
- 6.12.2 The pressure gauge shall have a blowout release. The blowout release should be so located that in the event of an explosion or fracture of the pressure element of the

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- gauge, the blast will be away from the front. The gauge window shall be made of 'material of non-splintering glass or of clear plastic materials.
- 6.12.3 A tap or restrictor shall be provided so that if pressure gauge and connection hose are removed from the apparatus, flow will not exceed 25 lit/Min at full cylinder pressure, if the gauge or flexible connecting tube be damaged after the apparatus has been functioning for a period of time equal to half the nominal working duration with an air consumption of 40 lmin the loss of air from the damaged component shall not reduce the normal effective duration of the apparatus by more than the reserved period.
- 6.13 **WARNING DEVICE**
The apparatus shall be provided with warning whistle next to the pressure gauge. It shall be consuming minimum amount of compressed air and should emit continuous at least 90 dbls sound. Warning whistle next to pressure gauge enables to user to ascertain his whistle and can check the same.
- 6.14 **BACK PLATE**
It is to be made of light weight glass and carbon filled nylon composite back plate and intrinsically flame retardant 100% Kevlar webbing and 3 padded harness. Cylinder band should be made up of 100% Kevlar.
The back plate shall be so designed that the use can lift the set by having a firm grip of back plate in order to avoid lifting of set from cylinder valve or body harness. The method of fixing cylinder shall be such that 4, 6 and 9 liter cylinder of working pressure 200/207/300 bar can be fitted without any alternation.
- 6.15 **PRESSURE REDUCER**
The apparatus shall be provided with a diaphragm less piston pressure reducer which is capable of reducing pressure from 300 bars to 7 bar (approx.). The designing ' shall be such that back pressure development shall be minimum, second inept outlet shall be provided on the reducer. High pressure and medium pressure safety shall also be provided on the reducer.
- 6.16 **COMMUNICATIONS:**
It should be designed for use with standard carbon composite SCBA, this unique radio communication interface should fully interface & integrate with existing standard radios available universally and must be intrinsically safe and approved to ENK136 Class3.
- 6.17 **ADSU**
 - Should be made of solid state technology - infrared motion sensor with no internal contacts to wear out.
 - Should be provided with long life lithium magnesium dioxide batteries.
 - Should have loud 112 decibel alarm.
- 6.18 **GAS CYLINDER & MAIN VALVE,**
Cylinder used shall be of steel having 616.8 liter water capacities, 300 bar working pressure 1800 Liters compressed air for 45/46 minute duration. The cylinder & valve should be approved by Chief Controller of Explosive, Nagpur, India.
- 6.19 **PACKING**
The breathing apparatus shall be packed in hard bag molded plastic or FRP.
- 6.20 **MARKING**
The trademark of manufacturers Identification shall be marked on the facemask, demand valve, pressure reducer and back plate. The serial number of the set and the date of manufacturing shall also be marked on the back plate.
- 7.0 **FIRST AID KITS**
- 7.1 **SCOPE**
This standard specifies the contents of portable first-aid kit intended for providing immediate and effective first-aid treatment of common injuries.
First aid kits shall be as per relevant code IS: 13115.
- 8.0 **TELESCOPIC LADDER (ALLOY ALUMINUM)**
Alloy Aluminum Telescopic Ladder: An alloy aluminum self-supported extension ladder shall be made from sides of "Round "section Heavy duty and steps 1" Dia non-slip corrugated tubing, complete with all safety devices and limits & rubber Shoes folding platform, safety rings hand rail fitted to extending section, that can lock at any required height. Height shall not less than 25 feet.
- 8.1 **DESCRIPTION;**

TECHNICAL REQUIREMENTS

Telescopic extension ladders shall be easily portable and closed length of 5 feet, extending to a length of 25 Feet and adjustable features wide comfortable treads and an automatic locking system. This ladder shall be easy to store, transport and carry which makes it ideal for fire and rescue use.

- Telescopic design for easy transporting and storage
- Automatic locking mechanism for convenience and security
- Light weighted but strong alloy aluminum construction
- Large slip – resistant feet
- Suitable for firefighting and rescue works

8.2

SPECIFICATION:

a. Closed height	:	5 feet
b. Extended height	:	not less than 25 feet
c. Maximum load	:	200 kg
d. Weight	:	20±5 kg
e. Class use	:	Firefighting and Rescue works
f. Material	:	Alloy Aluminum

9.0

SPECIFICATION OF FIBER GLASS BLANKET

Fiber Glass Blanket shall be made of fiber Glass fabric of 01mm thick fabric an ideal material and made of imported Dual Mirror. Aluminized Glass fiber fabric which will be approved by the center of Environment and Explosive Safety (CFEES). The fire blanket for welding shall be made fiberglass fabric, coated fiberglass fabric or silica fabric and finished with making by edge `wrapping, metal buckles and finished with plastic bag and labels.

The product shall be woven with specific high twisted yarn and then treated; the heat resistance temperature of the blanket shall be about 18000C with special treatment. To meet the heat resistance requirement, the fabric shall bed most suitable to meet the heat resistance requirement. Fire Blankets shall be generally used for covering the area while welding and occasionally for extinguishing the fire. Size of blanket shall be :6 Ft X 6 Ft.

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MULTIPURPOSE FLOW NOZZLE

The branch shall be made of extruded Aluminum Alloy hard anodized for resistance to corrosion having light in weight and hydraulically efficient design for low back thrust allowing for extended operation with multiple flow settings. It shall be capable for making hollow jet, Spray, and Fog in different fire fighting situations. The variable flow rate shall be adjusted from 360 LPM to minimum 900 LPM at 7 Kg/cm² and flush without shutting down. It shall have a Spray angle of 160° and horizontal throw in still air around 35 meters at 7-8 bar pressure. Spinning teeth shall be provided at the outlet to give an effective dense fog. A Pistol grip handle of rubber coated shall be provided for easy handling of branch.

The provision to shut-off pressure assisted flush without shutting down shall be provided. WEIGHT : Not more than 3.5 Kg , INLET: 63 mm Instantaneous Male Coupling.

11

PORTABLE THERMAL IMAGING CAMERA

The thermal imagine camera shall be capable help to locate victims in smoke-filled, dark and high-temperature condition. It shall be Identifies live victims by measuring the body temperature up to a distance of 1.2 miles. The thermal imaging camera shall be fully radiometric operating infrared camera system to capture and display thermal images and thermal profiles of objects.

The thermal camera incorporates the latest technology due to a USB 2.0 interface that allows a real-time thermal imaging with 128 images per second and simultaneous real time images with 60 HZ as well as stationary and portable operation that is very well priced. The images shall be archived as snapshots or as video sequences. The thermal camera shall be equipped with a small bolometer (UFPA) with 160 x 120 pixels and 25 x 25 µm pixel size. The high thermal sensitivity allows capturing finest details. The thermal camera shall be ideal equipment in areas of research and development, checkpoints, process automation or for general portable tasks. Via a USB cable the thermal camera shall be connected to a computer and be read-out without further ado.

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The temperature data of the thermal camera shall be transferred as a thermal image to the provided software Connect. Based on PI-SPECTRAL technology the real-time picture shall be recorded through a visual channel as a real image (VIS) combined with a thermal image (IR) simultaneously. The software also allows remote-controlling the camera.

Furthermore, the camera features a line scan camera function allowing monitoring moving objects during processing. With a weight of not more than 1.2 kg, the thermal camera shall be very light and compact design without comparison. The thermal camera combines portable and compact application with stationary operation. Some of the application ranges shall be electronic development, process controlling during extruding, process controlling during calendaring or development and processing of solar technology, LCD flat screens or any other electronic types of equipment.

TECHNICAL SPECIFICATION OF THERMAL IMAGINE CAMERA:

Imaging Performance	
FOV / Minimum focus distance	25° × 19° / 0.4 m
Spectral range	7.5–13 μm
Image frequency	60 Hz
Focus	Manual
Focal Plane Array (FPA)	Uncooled micro bolometer
Image presentation	
Display	Built-in 3.5" LCD touch screen, 320 × 240 pixels
Measurement	
Accuracy	±2 °C or ±2% of reading
Measurement analysis	
Automatic hot/cold detection	Auto hot or cold spot meter markers within area 0o C to +900oC
Emissivity correction	Variable from 0.01 to 1.0 or selected from list of materials
Measurement corrections	Reflected temperature, optics transmission and atmospheric transmission
Isotherm	Detect high/low temperature/interval
Laser pointer	
Laser alignment	Position is displayed on the IR image
Set-up	
Image controls	Palettes (Arctic, Gray, Iron, Lava, Rainbow and Rainbow HC), image adjustment (auto/manual)
Set-up controls	Local adaptation of units, language, date and time formats; automatic shutdown , display intensity
Image storage	
Format	Standard JPEG - including measurement data on SD memory card
Type	IR/visual images; simultaneous storage of visual and IR images
Power	
Battery type	Lithium-Ion (field replaceable) - 4 hours operating time
Charging system	In camera, AC adaptor, 2-bay charger or 12 V from a vehicle
Power management	Automatic shutdown and sleep mode (user selectable)
AC operation	AC adaptor, 90-260 V AC
Adaptor voltage	12 V output to camera
Environmental specifications	
Operating temperature range	-15 to +50 °C
Storage temperature range	-40 to +70 °C
Humidity	IEC 60068-2-30/24 h 95% relative humidity +25 °C to +40 °C / 2 cycles
Shock / Vibration	25 g (IEC 60068-2-29) / 2 g (IEC 60068-2-6)
Drop	2m
Encapsulation	IP 54 (IEC 60529)
Data communication interfaces	
Interfaces	USB-mini, USB-A, Composite video
USB	USB-A: Connect external USB device - USB-mini-B: Data transfer to and from PC / Streaming MPEG 4

TECHNICAL REQUIREMENTS

Physical characteristics	
Camera weight, incl. battery	Not more than 1.2 KG
Camera size (L × W ×H)	246 × 97 × 184 mm

PART-B
VOLUME – I
CHAPTER – M5
AIR CONDITIONING
&
VENTILATION SYSTEM

TECHNICAL REQUIREMENTS

1.00.00 GENERAL

1.01.00 This section of specification covers details of system specifications, detailing the areas to be air conditioned and ventilated, basis of design, brief description of the system, equipment and services to be furnished by bidder. The supply, delivery and erection of the entire equipment listed here shall be in bidder's scope of work.

1.02.00 CODES & STANDARDS

1.02.01 The design, manufacture and performance of equipment shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment are to be installed. Nothing in this specification shall be considered to relieve the bidder of this responsibility.

1.02.02 Unless otherwise specified, equipment shall conform to the latest applicable BEE, ECBC, Indian or IEC standard. Equipment complying with other authoritative standards such as British, USA, ASHRAE etc. will also be considered if it ensures performance equivalent or superior to Indian Standard.

2.00.00 AREAS TO BE COVERED UNDER AIR CONDITIONING SYSTEM

2.01.00 The areas to be air-conditioned shall be as follows:

- a) Main plant control room, control equipment room, UPS rooms etc.
- b) Office room, meeting/conference room, shift in-charge room, etc.
- c) Various miscellaneous rooms/areas covered under Bidder's scope.

3.00.00 AREAS TO BE COVERED UNDER VENTILATION SYSTEM

3.01.00 The areas to be ventilated by Mechanical Ventilation process (using Roof extractors/ Supply and/or Exhaust fans/back draft dampers/intake louvers) shall consist of but not limited to the following:

- i) Complete areas of Machine Hall (plant Building) other than the areas which are air conditioned.
- ii) Switch gear building in transformer area, LT switchgear room and various MCC, cable gallery areas.
- iii) All other areas like pump houses, stores, pantry, etc. and various non-air conditioned areas which requires ventilation.
- iv) Battery rooms and other fumes/odor generating areas
- v) All Toilets & Pantries (to be provided with propeller exhaust fans)
- vi) Any other areas which are not covered by Air-Conditioning system.

4.00.00 REDUNDANCY OF EQUIPMENTS

4.01.00 a) 100% standby shall be provided for control rooms/RIO room/VFD Room, etc. served by ductable split/package type air conditioners.

At least one (1) no. unit, capacity same as each working unit as a common standby shall be provided for control rooms/RIO room/etc. served by non-ductable split (cassette / Hi-wall) type air conditioners. No stand-by shall be provided for office areas of other buildings.

b) Fresh air fans shall be 1 x 100 % capacity for each PAC room.

5.00.00 DESCRIPTION OF AIR CONDITIONING SYSTEM SCHEME

5.01.00 PACKAGED AIR CONDITIONER:

(a) Packaged air conditioners shall be an encased assembly as a self-contained unit primarily for floor mounting, designed to provide free delivery of conditioned air to

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the conditioned space. It shall include a primary source of refrigeration for cooling and dehumidification, means for circulating and cleaning air and means for heating and humidifying air. Fresh air fan shall be provided in PAC Room.

- (b) The cabinet, housing the components of packaged air conditioners, shall be of heavy gauge sheet steel and suitable for floor mounting. The access panels shall be of easily removable type. The entire casing shall be thermally insulated with 25 mm thick insulation of totally flame proof type (T.F. type). Suitable drain connection shall be provided for removal of condensate collected inside a tray under cooling coil.
- (c) Controls shall be so provided that failure of one equipment of PAC will automatically trip that PAC unit.
- (d) HP and LP cutout shall be provided for compressor protection. A thermostat with adjustable setting shall also be provided in the return air circuit to control the room temperature by ON-OFF mode.
- (e) Provision shall also be made for manual re-starting and stopping of the compressor.
- (f) Interlock shall be provided such that compressor can start only starting the air handling fan.
- (g) Interlock shall be provided so that compressor can start only if condenser fan is running. Further if the condenser fan stops, the compressor shall also trip.
- (h) To control the humidity throughout the year, the humidistat shall be interlocked with humidifier and reheater.

5.02.00 HI-WALL SPLIT/CASSETTE AIR-CONDITIONERS

5.02.01 Hi-wall Split/cassette air conditioners shall in general consist of the following:

- i) Casing
- ii) Hermetically sealed rotary/scroll Compressor
- iii) Air cooled condenser
- iv) Evaporator and condenser cooling fan
- v) Cooling coil (copper).
- vi) Filters
- vii) Piping, valves, réfrigérant strainer, insulation, etc.
- viii) Controls, instruments, control panel/starter panels.
- ix) Vibration isolator pads, etc. if required.
- x) Refrigerant as per manufacturer practice.

Note: (1) Humidity control inside air-conditioned space served by split air conditioners (Hi-wall / Cassette/ Ductable) is not envisaged.

(2) Air conditioners shall conform to minimum star rating as per latest code/standard/guidelines issued by Bureau of Energy Efficiency (BEE), Ministry of Power, Govt of India.

5.03.00 Indoor unit of Ceiling Mounted Cassette Type Unit (Multi Flow Type):

The housing of the unit shall be powder coated galvanized steel. All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view.

Unit shall have four way supply air grills on sides and return air grill in center.

Each unit shall have high lift drain pump and very low operating sound.

6.00.00 EQUIPMENT DESCRIPTION - VENTILATION SYSTEM

6.01.00 Axial Fans

6.01.01 These fans shall have fixed / variable pitch cast aluminum blades of aerofoil design.

6.01.02 The fan casing shall be of heavy gauge sheet steel construction.

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- 6.01.03 Necessary rain protection cowl, inlet and outlet cones, bird protection screen, adjustable damper, vibration isolators, back draft dampers etc. shall be provided.
- 6.01.04 The speed of the fan shall not exceed 1000 rpm for fan with impeller diameter above 450 mm and 1500 rpm for fan with impeller diameter 450 mm or less. However, for fans having static pressure of 30 mm WC or above the speed of the fan shall not exceed 1500 rpm for fan with impeller diameter of above 450 mm and 3000 rpm for fan with impeller diameter of 450 mm or less. The first critical speed of rotating assembly shall be at least 25% above the operating speed.
- 6.01.05 All other accessories like supporting structure etc. as required shall be provided.
- 6.01.06 Fans of capacity 1000 m³/hr & lower shall be of propeller exhaust type.
- 6.01.07 Battery rooms (if applicable) shall be provided with spark proof (with flame proof motor) fans.

6.02.00 Roof Ventilators

- 6.02.01 The roof extractors shall be "COWL" type.
- 6.02.02 Impeller shall be of axial flow type, cast Aluminium in one piece and dynamically balanced. Casing shall be heavy gauge sheet steel construction of 3 mm thick for impeller upto 750 mm diameter and 5 mm for fans with impeller of diameter 750 mm and above. In casing, access door with locking arrangement be provided.
- 6.02.03 The cowl shall be designed for weather protection of the fan also inside of the roof on which the extractor is installed. Galvanized bird screen of 15 mm Square be provided with the cowl. All accessories, steel supports as required will be provided.
- 6.02.04 The speed of the fan be limited as per limitation given above for axial fans.
- 6.02.05 All accessories rain protection exhaust hood, transformation piece, vibration isolators, steel supports vibration isolators, bird screen, etc. as required shall be provided.
- 6.02.06 The vibration level for fans shall be as per ISO: 14694.

7.00.00 Pan Humidifier:

Pan humidifier shall be made of 22 gauge SS 304 tank, duly insulated with 25 mm thick resin bonded fiber glass insulation (min. 24 Kg/m³ density) with 0.5 mm GSS cladding. The humidifier shall be complete with stainless steel immersion heaters, safety thermostat, float valve with stainless steel ball, sight glass, overflow and drain connections, steam outlet nozzle and float switch. Step controller shall be provided for switching on / off heater banks as per system requirement.

8.00.00 Material of Construction for Piping & Fittings

- a) Refrigerant piping: : Copper tubes as per IS:2501 (copper material as per IS:191 hard copper grade).
- b) Drain piping : Heavy grade-IS:1239 & galvanized as per IS:4736.

9.00.00 AIR FILTERS

9.01.00 Pre Filter

- 1) Type: Flange / Cassette
- 2) Pre-filter shall contain washable non-woven synthetic fiber or High density Polyethylene (HDPE) media having 18G GSS / 16G Al alloy frame. The filter media shall be supported with HDPE mesh on air inlet side & Aluminium expanded metal on exit side or G.I. wire mesh on both sides.
- 3) **Other requirements: (as applicable)**
 - a) Suitable aluminium spacers be provided for uniform air flow;

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- b) Casing shall be provided with neoprene sponge rubber sealing.
- c) Capable of being cleaned by water flushing.
- d) Density of filter medium shall increase in the direction of air flow in case of metallic filter.
- e) Filter media shall be fire retardant and resistant to moisture, fungi, bacteria & frost.

4) **Efficiency:**

Average arrestance of 65 - 80 % when tested in accordance with BS:6540/ASHRAE – 52 – 76 / EN-779.

- 5) Minimum thickness : 50 mm
- 6) Face Velocity : Not more than 2.5 m/sec.
- 7) Pressure drop : Initial pressure drop - Not to exceed 5.0 mm WC at rated flow.
Final pressure drop - Upto 7.5 mm WC.
- 8) Location : a) At the suction of each Fresh air fan
: b) At the suction of each Supply air fan

9.02.00 Fine Filters (Microvee type)

- 1) Type : Flange / Cassette
- 2) Fine filter shall contain washable non-woven synthetic fibre or High density Polyethylene (HDPE) media having 18G GSS / 16G Al alloy frame. The filter media shall be supported with HDPE mesh on air inlet side & Aluminium expanded metal on exit side or G.I. wire mesh on both sides.
- 3) Other requirements : a) A neoprene sponge rubber sealing shall be provided on either face of the filter frame.
b) Capable of being cleaned by air or water flushing.
c) Filter media shall be fire retardant and resistant to moisture, fungi, bacteria & frost.
- 4) Efficiency : Average arrestance > 90% when tested in accordance with BS:6540/ASHRAE–52-76 / EN-779.
- 5) Minimum thickness : 150 mm or 300 mm.
- 6) Face Velocity : Not more than 1.2 m/sec for 150 mm and not more than 2.4 m/sec. for 300 mm.
- 7) Pressure drop : Initial pressure drop - Not to exceed 10 mm WC at rated flow.
Final pressure drop-Up to 25 mm WC.
- 8) Location : i) At the discharge of each Fresh air fan

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- ii) At the discharge of each supply air fan having static pressure 30mm wc or more for AC system.

10.00.00 **LOW PRESSURE AIR DISTRIBUTION SYSTEM**

10.01.00 Material of air distribution system shall be through galvanized steel sheet (Conforming to Class 275 of IS: 277) or Aluminium alloy (grade 19000 / SIC or 3100 / NS3 of IS: 737)

10.02.00 **Thickness of rectangular ducts shall be as follows:**

Larger Dimension of duct (mm)	Thickness of GI sheet(mm)	Thickness of Aluminium sheet (mm)
up to 750 mm	0.63 (24 G)	0.80
751 to 1500	0.80 (22 G)	1.00
1501 to 2250	1.00 (20 G)	1.50
2251 & above	1.25 (18 G)	1.80

10.03.00 **Thickness of round ducts shall be as follows:**

Diameter of Round duct (mm)	Thickness of GI sheet(mm)	Thickness of Aluminium sheet (mm)
150 to 500	0.63	0.80
501 to 750	0.80	1.00
751 to 1000	0.80	1.00
1001 to 1250	1.00	1.50
1251 & above	1.25	1.80

10.04.00 **Duct Fabrication and Supports:**

- Duct fabrication shall be as per the latest relevant BIS/SMACNA standard.
- Ducts for A/C system may be site fabricated or factory fabricated and installed at site. However, in case of partly used factory fabricated ducts, vendor shall take back the unused ducts.
- The ducts routed inside the buildings with larger side greater than 2250 mm shall be supported by 16mm MS rods and 50x50x3 mm MS double Angles while those below 2250 mm shall be supported by 10mm MS Rods and 40x40x3 MS angles. The duct supports shall be at a distance of not more than 2000 mm for A/C system. The MS rods for these ducts routed inside the building shall be hung from the existing floor beams/wall beams/roof beams/columns with provision of necessary auxiliary or special steel members or by hooks or can be provided by contractor by dash fasteners fixed to the ceiling slab. No supports shall be taken from horizontal/vertical bracings of the structures. All items of duct support including MS rods, MS angles and double angles, auxiliary or special steel members, hooks, dash fasteners coach screws and all other supporting material required shall be provided by the bidder.

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- d) Where the sheet metal duct connects to the intake or discharge of fan units a flexible connection of fire retarding, at least 150 mm width shall be provided of closely woven, rubber impregnated double layer asbestos/canvas or neoprene coated fibre glass.
 - e) All curves, bends, off-sets and other transformations shall be made for easy and noiseless flow of air. The throat of every branch duct shall be sized to have the same velocity as in the main duct to which the branch duct is connected.
 - f) Wherever duct passes through a wall, the opening between masonry and duct work shall be neatly caulked or sealed to prevent movement of air from one space to the adjoining space.
 - g) Wherever pipe hangers or rods pass through the ducts, light and streamline easement around the same shall be provided to maintain smooth flow of air.
 - h) Access doors shall be provided in the duct work or casing on the both sides of the equipment to be serviced. All access doors shall be of adequate size and shall be lined with substantial felt edging to prevent air leakage. Access doors shall be of built up construction, structurally strong and each shall have at least two hinges. Access doors shall have two rust proof window sash of approved type. All doors shall be set so as to flush with insulation or plaster finish on the duct.
- 10.05.00 Splitters and dampers shall be provided for equipment/area isolation and for proportional volume control of system. The same shall be minimum 16 gauge GS sheet of quadrant type with suitable locking device, mounted outside of duct in accessible position.
- 10.06.00 **Factory fabricated ducts:**
- i) All ducting shall be fabricated of LFQ (Lock Forming Quality) grade prime G.I.
 - ii) Unless otherwise specified here, the construction, erection, testing and performance of the ducting system shall conform to the SMACNA-1995 standards ("HVAC Duct Construction Standards-Metal and Flexible-Second Edition-1995" SMACNA)
 - iii) All ductwork including straight sections, tapers, elbows, branches, show pieces, collars, terminal boxes and other transformation pieces must be factory fabricated by utilizing the machines and processes as specified in SMACNA or by equivalent technology. In equivalent method, the fabrication shall be done by utilizing the following machines and process to provide the requisite quality of ducts and speed of supply:
 - a. Coil lines to ensure location of longitudinal seams at corners/folded edges only to obtain the required duct rigidity and low leakage characteristics. No longitudinal seams permitted along any face side of the duct.
 - b. All ducts, transformation pieces and fittings to be made on CNC profile cutters for required accuracy of dimensions, location and dimensions of notches at the folding lines.
 - c. All edges to be machine treated using lock formers, flangers and roll-bending for turning up edges.
 - d. Sealant dispensing equipment should be used for applying built-in sealant in Pittsburgh lock where sealing of longitudinal joints are specified. Sealing of longitudinal joint is compulsory for the ducts over 2" w.g. static pressure
 - iv) All transverse connectors shall be 4-bolt slip-on flange system with built-in sealant, if any. To avoid any leakage additional sealant shall be used.

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- v) Factory fabricated ducts shall have the thickness of the sheet as follows:

Sl. No.	Size of Duct	Sheet Thickness
i)	upto 750 mm	0.63 mm
ii)	751 mm to 1500 mm	0.80 mm
iii)	1501 mm to 2250 mm	1.00 mm
iv)	2251 mm and above	1.25 mm

11.00.00 **Diffusers, Grills, Dampers & Intake Louvers:**

- 11.01.00 Supply air diffusers/grills with factory fitted volume control dampers be provided for all air-conditioned areas.
- 11.02.00 Return air diffusers of air-conditioned areas shall be without volume control dampers.
- 11.03.00 The diffusers/grills shall be of extruded Aluminum of minimum 1.2 mm thick with powder coating. The colour of power coating shall be as per the interior Décor.
- 11.04.00 Supply air grills shall be of double deflection type and return air grills shall be of single deflection type.
- 11.05.00 The nozzle type diffusers shall be fabricated from minimum 1.5mm aluminium sheet. The base shall be fixed type. The nozzle shall be of volute design with the spout diameter being half the base dia. and designed for low noise and long throw. The nozzle shall be able to rotate to any angle within the base. The whole assembly shall be powder coated as per interior decor.
- 11.06.00 All volume control (VC) damper shall be operated by a key from the front of the grills/diffusers and shall be of GI sheet.
- 11.07.00 The thickness of VC dampers shall be of minimum 20 gauge and thickness of louvers shall be of minimum 22 gauge.
- 11.08.00 Suitable vanes shall be provided in the duct collar to have uniform and proper air distribution. Bank of Baffles wherever required shall also be provided.
- 11.09.00 Fire dampers shall be motor operated type and shall have fire rating of minimum 90 minutes.
- 11.10.00 All plenum chambers of connections to fans, dampers etc shall be constructed in 18 gauge GS sheet and supported on MS angle frames.
- 11.11.00 All ducting surfaces coming in contact with corrosive fumes or gases shall be painted with three coats of epoxy paint over a coat of suitable primer.
- 11.12.00 Inlet/Exhaust air grills/louvers are required for all negatively pressure ventilated areas. Back draft dampers shall be provided for all areas pressurised under ventilation system.
- 11.13.00 The diffusers/grills shall be of powder coated mild steel construction for Ventilation system.

12.00.00 **Thermal and Acoustic Insulation**

- 12.01.00 **A)** Application with Glass Wool
- (a.) All surfaces to be insulated both thermally and acoustically shall be thoroughly cleaned, dried and an adhesive (CPRX compound of Shalimar Tar Products or Equivalent) be applied @ 1.5 kg /sqm on the surface.
- (b.) Insulation material (either expanded polystyrene foam or Glass Wool/ Glass fiber or Equivalent) shall be struck to the surface. All the joints shall be sealed with bitumen.
- (c.) Insulation mass to be covered with 500 gauge polythene sheet with 50 mm overlaps and sealing all joints on hot side.
- (d.) Insulation Finish of types specified under shall be provided thereafter.

B) Application with Nitrile Rubber:

- (a) All surfaces to be insulated shall be properly cleaned.

TECHNICAL REQUIREMENTS

- (b) A suitable adhesive such as SR 998 or equivalent shall be applied over the surfaces to be insulated and insulation material surfaces.
 - (c) Insulating material shall than be pasted onto the surfaces in a manner to avoid stretching and any air entrapment within.
 - (d) Two layers of Glass Cloth with a suitable adhesive as SR 998 or equivalent shall be then applied over the insulating material to avoid surface weathering.
- C) Application with FR Closed Cell Chemically Cross Linked Polyethylene Material (XLPE)**
- (a) All surfaces to be insulated shall be properly cleaned of any dust, grease and moisture.
 - (b) A suitable adhesive, normally, a pressure sensitive acrylic base, such as SR 998/STAR Glue R242 or Neosole AA 900 or equivalent shall be used to paste the insulating material over the cleaned surface.
 - (c) XLPE cut to size for each surface, with overlaps provided for two faces shall be stuck to the surfaces in a manner to avoid air entrapment. The extent of over-lap shall be equivalent to the thickness of the material to be applied. The adhesive is applied on both the surfaces to be insulated and the insulation foam material.
 - (d) Application of the insulating material to surfaces should preferably be carried out at ground level, in a clean dust free area.
 - (e) All joints- lateral & longitudinal, shall be taped with self adhesive aluminium foil tape 75 mm wide. The insulation over the surface shall be then held in position with 12mm wide PVC straps at every 600mm, to provide a neat & clean finish.

12.02.00

Type of Insulation & Finish

Sl. No.	Surface	Insulation Material	Insulation Form	Thick (mm)	Finish (mm)
1.	Supply & return air duct of A/C System	Resin bonded glass wool	Roll /Slab	50	F-3
		or Closed Cell Elastomeric Nitrile Rubber Or Polyisocyanurate Foam	sheet	19	As per manufacturer std.
			Slab	30	F-3
2.	Acoustic insulation of duct	Resin bonded Glass wool	Slab	25	As per specifications
3.	Exposed air duct	Resin bonded Glass wool	Roll	50	F-4
		Or Polyisocyanurate Foam	Slab	50	F-4(a)

12.03.00

Specification for insulation shall be as follows: -

TECHNICAL REQUIREMENTS

Insulation Material	Code	Thermal conductivity (w/m/°C)	Density Kg/m ³
Resin bonded glass wool	IS:8183	0.049 at 50°C	i) 24 (For thermal insulation) ii) 48(For acoustic insulation)
Mineral wool pipe section Min.Gr.2	IS:9842	0.043 at 50°C	144
Closed Cell Elastomeric Nitrile Rubber		0.036 at 20°C	40-60
Polyurethane Foam	IS12436	0.03 at 50°C	34 + 2
Polyisocyanurate Foam		0.03 at 50°C	34 + 2
Note : Insulation used for HVAC application shall be CFC/HCFC free			

12.04.00

The specification for various finishes shall be as follows

a)	<p>Finish F-1 (with Resin Bonded Glass Wool/Resin Bonded Mineral Wool)</p> <p><u>Step-1</u> Wrapping of Poly-Bonded Hessain (PBH – to act as vapour seal) on outer surface of insulation with 50 mm overlap stitching and sealing of overlap with synthetic adhesive like CPRX or Equivalent compound.</p> <p><u>Step-2</u> The surface then shall be wrapped with 19 mm mesh 24 SWG GI wire netting, butting all the joints and laced down with 22 SWG lacing wire.</p> <p><u>Step-3</u> Sand cement (4:1) plaster shall be applied in two layers totalling to 12.5 mm thick, the second layer being brought to a smooth finish. A water proofing compound shall be added to the cement before its application.</p>
b)	<p>Finish F-1(a) (With Polyurethane Foam & Polyisocyanurate Foam)</p> <p>Wrapping of two layers of 7 mil 10x10 mesh glass cloth dipped in suitable adhesive such as SR 998 or Loid Bond 130 or equivalent.</p>
c)	<p>Finish F-2</p> <p><u>Step-1</u> Insulation shall be covered with 500g polythene with 50mm overlap and sealing of overlap with synthetic adhesive like CPRX/ Loid Bond 83 or Equivalent compound.</p> <p><u>Step-2</u> Same as Step-2 of Finish F-1 above.</p> <p><u>Step-3</u> Same as Step-3 of Finish F-1 above.</p>
d)	<p>Finish F-3</p> <p><u>Step-1</u> Same as Step-1 of Finish F-2 above</p> <p><u>Step-2</u> The polythene shall be covered with 26 gauge Aluminium sheet and locking of joints with self-locking screws at a pitch of minimum 100 mm.</p>
e)	<p>Finish F-4</p> <p><u>Step-1</u> Same as Step-1 of Finish F-1 above.</p> <p><u>Step-2</u> Same as Step-2 of Finish F-1 above.</p> <p><u>Step-3</u> Same as Step-3 of Finish F-1 above.</p> <p><u>Step-4</u> Application of 3 mm thick coat of water proofing compound and wrapped with fibre glass RP tissue followed by final coat of 3 mm thick water proofing compound over the RP tissue.</p> <p><u>Step-5</u> After the above treatment, 22G Aluminium sheet cladding, properly stitched at all joints shall be provided over the external surface.</p>
f)	<p>Finish F-4(a) (With FR Closed Cell Chemically Cross Linked Polyethylene Material)</p> <p>Application of aluminium sheet 22G cladding to be provided over the XLPE insulating material. Cladding sheet is held in position with SDST screws @ 150 mm C/C over tongue-in-groove joints applied with afelt for sealing joint against water ingress.</p>

TECHNICAL REQUIREMENTS

	Al sheet joints to be done in a manner to shed water.
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12.05.00 For all inspection covers and hatches on equipment, pump casing, valve bodies and flanges (100 mm and above), insulation shall be applied so as to facilitate removal without minimum damage to the insulation by encasing the insulation in 24 gauge GI box or 22 gauge Aluminium sheet metal boxes which are bolted together around the equipment. However continuity of the vapour seal between the static and removable portions of the insulation is to be maintained.

13.00.00 **ACOUSTIC INSULATION**

- a) All ducts up to a distance of 5 meters from PAC shall be acoustically lined from inside with 25 mm thick resin bonded glass wool of 48 Kg/Cu.M. density and 30 gauge perforated aluminium sheet having 5 mm dia perforation at 8 to 10 mm centre-to-centre distance. Insulation shall be fixed on wooden frame of 600 x 600 mm dimension.
- b) Fibre glass tissue sheet shall be applied over the outer surface of insulation before applying perforated aluminium sheet. Application of acoustic insulation shall be inline with the requirements specified above.

14.00.00 **Condensing Unit (Air-Cooled D-X type), if applicable.**

Condensing unit	
Type	: Air cooled scroll type
Vibration isolators	: Steel spring / Neoprene rubber cushy foot type with isolation efficiency not less than 85%.
Compressor	
Type	: The Compressor shall be scroll, serviceable, either hermetic type or semi-hermetic type with automatic capacity control (minimum 3 steps).
Type of drive	: Motor driven
Refrigerant	: The refrigerant shall be R-134a/ R-410A/R-407C or any other environment friendly refrigerant.
Accessories	: High/Low pressure cutouts, oil pressure switches, relief valves, pressure gauges at each stage, lube oil and control oil pressure gauges, suction & discharge stop valves, Muffler, Crank case heaters, oil filters, magnetic oil separators, temperature indicators for lube oil/heaters, oil level indicators, safety thermostat for crank case heater, vibration isolators, etc.
Capacity	: Minimum capacity shall be suitable for the identified/selected at evaporating temperature and condensing temperature and shall be indicated.

15.00.00 **PLANT CONTROL (for package Air Conditioning/Cassette/Hi-wall Split Air Conditioning and Ventilation System):**

Control and interlocks for these type of units shall be as per manufacturer's standard practice. Brief scheme of controlling the operation, detailed description of the control system for safe and efficient operation of the plant shall be elaborated got approved from employer

15.01.00 **General**

- a) Separate emergency local stop push button shall be provided for each drive of A/C system and ventilation system.
- b) Status shall be provided of each drive of AC system and ventilation system at control room.
- c) All the annunciations related to failure of equipment, tripping of equipment, source of failure / reason due to which the equipment is stopped / tripped, low &

TECHNICAL REQUIREMENTS

high limits of parameters such as level, temperature, pressure drop, pressure etc shall be provided for each equipment of AC system and ventilation system .

- d) Relative humidity and temperature measurement of all control rooms and CERs, and all major air-conditioned areas shall be available in DDCMIS. Relative humidity and temp. measurement for main plant control room and CERs to be available in multiple numbers.

- 16.00.00 PAINTING:**
- 16.01.00 All the Equipments shall be protected against external corrosion by providing suitable painting.
- 16.02.00 The surfaces of stainless steel, Galvanized steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting. The Contractor shall clean the external surfaces and internal surfaces before Erection by wire brushing and air blowing. The steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shot blasting, etc. as per the agreed procedure.
- 16.03.00 For all the steel surfaces (external) exposed to atmosphere (outdoor installation), one(1) coat of red oxide primer of thickness 30 to 35 microns followed up with three (3) coats of epoxy paint, with 25 microns as thickness of each coat, shall be applied. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.
- 16.04.00 For all the steel surfaces inside the building (indoor installation), One (1) Coat of red oxide primer of thickness 30 to 35 microns followed up with two (2) coats synthetic enamel paint, with 25 microns as thickness of each coat shall be applied. For plant at coastal area, epoxy resin based zinc phosphate primer followed by epoxy resin based paint pigmented with titanium di-oxide shall be used in place of enamel paints.
- 16.05.00 For centrifugal fans/axial/Roof extractor fans - Casing shall have hot dip/ spray galvanization (minimum 60-micron DFT).
- 16.06.00 However for all parts coming in contact with acid fumes (in Battery rooms), a coat of epoxy resin-based zinc phosphate primer of minimum thickness 30 to 35 microns followed up with undercoat of epoxy resin-based paint pigmented with Titanium dioxide of minimum thickness of 25 microns shall be applied and a top coat consisting of one coat of epoxy paint of approved shade and color with glossy finish of minimum thickness of 25 microns.
- 16.07.00 Touch up painting shall be as per standard industrial practice.

PART-B
VOLUME – I
CHAPTER – M6
COMPRESSED AIR SYSTEM

TECHNICAL REQUIREMENTS

COMPRESSED AIR SYSTEM

1.00.00 SYSTEM DESCRIPTION

- 1.01.00 The compressed air system shall consist of Air compressors & their motor drives, Air Drying (ADPs) Plants, air receivers, instrumentation and control, control panels, interconnecting compressed air piping in the machine hall instrument air piping network, service air piping network.
- 1.02.00 The Air compressors & Drives, instruments, control panels and ADPs shall preferably be located indoor inside the machine hall and the air receivers shall be located inside the machine hall. The EOT crane in machine hall shall be used for the operation or maintenance of air compressors. In case the air compressors are not in approach of the EOT crane, separate monorail beam (along with supports) with electric hoist shall be provided for handling air compressors. Further, if Air Compressors, Air Drying Plants, Air Receivers, etc. are not possible to be placed within machine hall, then separate compressor house (monorail beam along with support & electric hoist by Contractor) shall be provided by Employer.
- 1.03.00 Air from Air compressors shall be dried in respective Air-Drying Plants and delivered to the Air receivers. From the Compressed air piping header at the downstream of Air receivers, instrument air piping shall be tapped and distributed as per requirement.
- 1.04.00 From the compressed air piping header at the downstream of Air receivers, service air piping shall be tapped and distributed as per requirement.
- 1.05.00 Compressor house (if required) shall be steel framed structure with brick wall up to windowsill height & single skin metal panel cladding above it.

2.00.00 EQUIPMENT DESCRIPTION:

- 2.01.00 The minimum requirements of design and construction features of various components of Compressed air system (screw type air compressor, air dryer, air receiver, etc.) are described below.

3.00.00 SCREW AIR COMPRESSORS

3.01.00 CODES AND STANDARDS

- 3.01.01 The design, manufacture, testing and performance of the various components of the Rotary Screw type Air Compressors shall comply with the requirements of relevant codes (IS-5456, IS-10431 [part -1], ASME PTC-9, IS-6206, IS-5727, ISO-1217 and CAGI).
- 3.01.02 Other International Standards like American/BS/DIN/equivalent or superior to above mentioned standards are acceptable. Where IS specification is not available, the equipment shall conform to one such International Standard, which shall be indicated in the proposal.

3.02.00 DESIGN AND CONSTRUCTION

- 3.02.01 The compressor shall be oil free multistage, horizontal, air-cooled rotary screw type, heavy duty, rugged construction. Their speed shall be so selected as to result in low maintenance and trouble-free operation under specified conditions.
- 3.02.02 The rotor and shaft shall be made of forged steel. The stator (casing) shall be of Cast-Iron (IS-210 grade) Construction with integral jacket cooling. The rotors shall be dynamically balanced to reduce vibration.
- 3.02.03 The seal rings and retainers shall be of stainless-steel construction and be free for radial self adjustment along the rotor shafts.
- 3.02.04 Bearings shall be high precision antifriction type (IS- 25 Grade 84). The axial thrust load shall be minimized by dividing the axial load of compression on the main and auxiliary bearings through suitable balancing arrangement.

TECHNICAL REQUIREMENTS

- 3.02.05 Any superior material & type (as per proven practice and relevant standard) of various components of screw compressor is also acceptable.
- 3.02.06 Lubrication system shall be as per manufacturer standard practices.
- 3.03.00 **Gear Box**
- 3.03.01 Gears shall have a rating of AGMA-12 or equivalent. Speed increasing gears between the motor and compressor stages shall consist of a common helical gear driving the pinion of each stage. Helical timing gears shall be mounted on the rotor shafts to maintain accurate relative rotor position.
- 4.03.00 PERFORMANCE REQUIREMENT**
- 4.03.01 Air Compressors (screw) shall be designed for continuous operation with high efficiency to satisfy the performance requirement.
- 4.03.02 The power rating of the driver shall be selected such that a minimum margin of **10%** is available over the power required to deliver rated capacity against rated pressure.
- 4.03.03 As more than one compressor with drive is specified, satisfactory operation in parallel shall be ensured without any uneven load sharing, undue vibration, keeping noise level within permissible limits for a number of compressors working simultaneously in the same room.
- 5.00.00 AIR RECEIVERS**
- 5.01.00 Capacity of each of the air receivers shall be of minimum 2 m³.
- 5.02.00 Receivers shall be vertical cylindrical vessel with dished ends.
- 5.03.00 The design pressure and temperature shall be minimum 10 Kg/cm² (g) and 50 deg.C respectively. Receivers shall be designed in accordance with Section VIII, Division 1 of ASME Code or equivalent.
- 5.04.00 Air receivers are to be provided with gasketed inspection manhole of minimum 500 mm diameter with cover plate, lifting handle, davit cap etc.
- 5.05.00 Receivers shall be of welded construction with minimum number of joints. Longitudinal seam in adjacent sections shall not be in same line. Welding shall be as per relevant codes. Filler material to have composition & structure as that of material welded. Welding electrodes to be approved by Employer. Electrodes to be dried before use.
- 5.06.00 Relief valves shall be provided to suit compressor capacity and set pressure of the same shall be atleast 10% above working pressure. The spring in relief valve shall not reset for any pressure more than 10% above or below the design set pressure.
- 5.07.00 Each receiver shall be provided with pressure indicator, temperature indicator and drain connection with electrically operated automatic drain trap arrangement with isolation and bypass valves. The drain trap shall be timer based. Manual draining facility shall also be provided in the drain trap.
- 5.08.00 The material of construction of shell, dished ends, flanges, etc of the air receivers shall be of carbon steel as per IS:2062 or equivalent.
- 6.00.00 INTAKE AIR FILTER AND SILENCER**
- 6.01.00 Filters with multiple elements quick removal type for easy cleaning shall be provided at suction of each air compressor and also be of heavy-duty dry type.
- 6.02.00 The filters shall be complete with integral silencers. Separate silencers, if specified, shall be provided. The filtering elements shall be easily removable for cleaning.
- 6.03.00 The filters shall be designed for an efficiency of not less than 99% for particles 2 microns and larger.

TECHNICAL REQUIREMENTS

7.00.00 AIR DRYING PLANTS

- 7.01.00 One number Air drying plant shall be provided for each air compressor envisaged for instrument and service air application. Drying shall be by adsorption process through a desiccant medium.
- 7.02.00 Air Drying (ADP) Plant shall be "Heat of (HOC) Compression type".
- 7.03.00 Regeneration of desiccant shall be achieved by "Heat of compression" method without any air purge loss.
- 7.04.00 Hot unsaturated compressed air shall be used for regeneration of exhausted desiccant.
- 7.05.00 Each ADP shall be provided with two adsorber towers each sized for design drying cycle of minimum 8 hours. After this period, the adsorber tower which was under drying mode shall be put under regeneration/reactivation mode while the other tower will take over the drying duty. The change of drying mode to reactivation mode or vice-versa shall be automatic with provision for manual operation also. The change over from one mode to another shall be through automatic solenoid operated valves.
- 7.06.00 In HOC type drier, the reactivation shall be achieved by the heat of the compressed air itself. The hot unsaturated compressed air from the outlet of last stage of compressor shall be passed through the adsorber tower. The moist air shall be cooled in dehumidifier and passed through the second adsorber for final drying.
- The design reactivation cycle/period of the tower shall be less than 8 hours including cooling period for desiccant.
- 7.07.00 Each ADP shall be provided with two (2) numbers of 100 percent capacity pre-filters and two (2) numbers of 100 percent capacity after-filters at the upstream & downstream of towers. The filtering media shall be of ceramic candle type elements designed to withstand atleast 50% of static pressure as differential pressure. However, as per manufacturer's standard & proven design, any superior material to the material specified is also acceptable. The pre-filters shall be provided with automatic electrically operated drain trap arrangement with isolation and bypass valves.
- 7.08.00 The adsorber tower shall be designed with sufficient cross-sectional area resulting low air velocity and pressure drop. Minimum 20% of desiccant depth shall be provided as free board in adsorber vessels. Adsorber vessels to be provided with suitable number of inspection/sight windows of "Persplex" for observation of adsorbent condition. Desiccant filling and removal connections shall be provided for the adsorber vessels.
- 7.09.00 The coolers/heat exchangers/ dehumidifiers of ADP shall be designed & constructed as per the requirements specified for "Intercoolers, After coolers & Oil coolers" above.
- 7.10.00 All pressure vessels such as pre-filters, after-filters, adsorber vessels, heaters, heat exchangers/de-humidifiers / coolers etc associated with ADP shall be designed in accordance with Section VIII, Division 1, of ASME Code or equivalent. The pressure vessels shall be provided with airtight gasketed manholes/handholes and relief valves.
- 7.11.00 Quantity of desiccant to be calculated shall take into account residual moisture content at the end of regeneration cycle.
- 7.12.00 Desiccant shall be activated alumina only and adsorption capacity and density of the same shall not be more than 8% and 900 kg/m³ respectively.
- 7.13.00 In case of Heat of compression type, adsorbers shall be sized so that even when the compressor is operating at part load, complete regeneration shall be achieved within the cycle time and quality of air (dew point) shall be maintained throughout the design cycle period.
- 7.14.00 Complete ADP equipment shall preferably be mounted on a skid.
- 7.15.00 Required sample connections in piping be provided for sampling of air at desired locations.

TECHNICAL REQUIREMENTS

- 7.16.00 Non-lubricated two way / three way / four way valves ball valves with pneumatic actuators be provided.
- 7.17.00 The material of Construction for various components of ADP shall be as per manufacturer's proven standard.
- 7.18.00 HOC dryers of single rotating drum type design using packed dessicant with in-built regeneration and adsorption compartments are also acceptable in place of specified twin-tower type dryers, if the design ensures specified performance guarantee. In case, the Contractor offers such a type, the same shall be of proven design and shall meet the conditions stipulated under "proven-ness criteria" in relevant sub-section of Part-A, of Technical Specification. The control & instrumentation requirements specified is applicable for such design also.

8.00.00 CONTROL PHILOSOPHY

8.01.00 GENERAL

- 8.01.01 The minimum requirements are specified herein and the same shall be elaborated by contractor. The Contractor shall include controls & instrumentation to facilitate safe, reliable and efficient operation for the system. The controls, protection, interlock and instrumentation system offered by the contractor shall be subjected to approval of the Employer during post award engineering stage.
- 8.01.02 Any of the compressor and Air drying Plant may be selectable for "shutdown", "working" or "standby" duty.
- 8.01.03 On tripping of working equipment, the standby equipment shall come into operation automatically in case of very low air pressure in the system.
- 8.01.04 All abnormal conditions used for tripping the compressor or any other equipment shall be provided with pre-trip audio-visual indication/annunciation in the control panel.
- 8.01.06 The following indications shall be made available in the control panels for repeating the same in main plant Control System / Panels.
- (a) Status of each compressor
 - (b) Instrument air pressure low/high
 - (c) Service air pressure low/high
 - (d) Dew point of instrument air
 - (e) Status of each ADP
- 8.01.07 Lube oil pressure and temperature in the oil circuit of compressor shall be automatically controlled.
- 8.01.08 Unless otherwise mentioned in the relevant electrical sub-section, automatic motor overload control system shall be included to permit continuous operation of compressors at minimum ambient air without exceeding the name plate rating of the motor.
- #### **8.02.00 Screw Compressor**
- 8.02.01 Each compressor shall be in the control panel to operate either in Base duty (Auto Load-Unload) or Standby duty (Auto On-Off) mode.
- 8.02.02 In "Base duty" mode, whenever air supply from compressors exceeds the demand, control system shall operate the load-unload circuit at a predetermined set pressure, throttle the inlet valve and open the blow off valve. The compressor shall run in unloaded condition. When system pressure drops due to more demand, the load-unload circuit shall operate again to bring the compressor to 100% load after closing the blow -off valve.

TECHNICAL REQUIREMENTS

- 8.02.03 In "Stand-by" mode the compressor shall automatically assist base load compressors during periods of peak air demand. When air pressure in the system reaches a pre-set lower limit, compressor should start in unloaded condition and the compressor shall be fully loaded. When the pressure in the system rises to pre-set high value, the compressor shall be unloaded and shall run in idling mode for a specific period (set by a timer). The compressor may be loaded to full load in case of drop in system pressure or compressor may be stopped in case the system pressure does not drop and compressor continues to idle for more than a pre-set time.
- 8.02.04 The control system shall provide warning to the operator that a hot-start condition exists for the motor driver and adequate cool-down period has not occurred after the motor was shut down.
- 8.02.05 The alarms and shutdown scheme mentioned below are suggestive and shall be provided as per manufacturer's standard practice meeting the safe operational requirement of the equipment/system each compressor:-
- | | | |
|-----|---|--------------|
| (a) | "Air temperature high" at inlet to last stage | Alarm & trip |
| (b) | "Low lube oil pressure" | Alarm & trip |
| (c) | "High Lube oil supply temperature" | Alarm & trip |
| (d) | "High oil filter differential pressure" | Alarm |
| (e) | "Low lube oil level in lube oil sump" | Alarm |
| (f) | "High inlet air filter differential pressure" | Alarm & trip |

8.03.00 Air Drying Plant

- 8.03.01 Sequential operation of the adsorber towers & air compressors shall be controlled automatically with a provision for manual take over.
- 8.03.02 Change-over of tower from drying mode to regeneration mode shall happen automatically if the dew point is high at the outlet of ADP sensed by the dew point (using aluminium oxide probe) meter/sensor. Automatic operation during regeneration, starting and stopping of blowers, starting and stopping of heaters, etc shall be timer controlled. During the process, in case, operation is taken over manually from the panel through push button or selector switch, the sequential operation shall start with the manual initiation for each of the steps.
- 8.02.03 The control system shall provide the (as minimum) alarms, "High Reactivation air temperature", "Low Reactivation air temperature", "Low air pressure at the outlet of ADP" and "High dew point at the outlet of ADP", etc. Adequate number of temperature elements etc. shall be provided for measurement and monitoring of the same.
- 8.02.04 For rotary drum type Air drying plant, control philosophy as per manufacture's standard and proven practice is also acceptable.

9.00.00 PAINTING

All the equipments shall be protected against external corrosion by providing suitable painting.

The surface of SS, galvanized steel, Gun metal, Brass, Bronze and non-metallic components shall not be applied with any painting.

The steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shot blasting etc as per standard procedure. All Painting shall be done as per approved painting scheme of the vendors/Manufacture which shall be submitted by bidder and as approved by Employer.

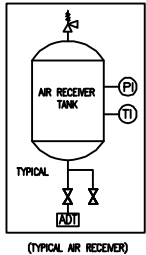
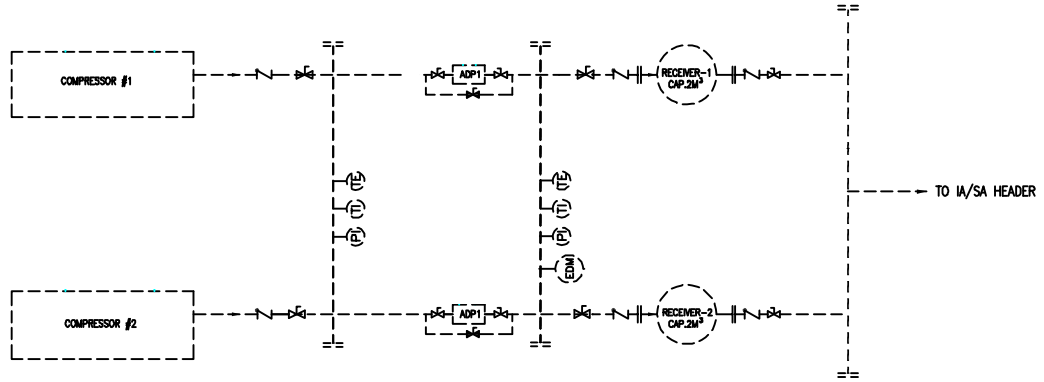
- 10.00.00 Also refer "Schematic Drawing of Compressed Air System (6400-001-POM-A-005)" for instrument & service air application, Annexure-I to this chapter.

TECHNICAL REQUIREMENTS

11.00.00 Piping & Valves:

	Material of Construction
Piping	ASTM A-53 type E Gr. B galvanized.
Valves	Galvanized carbon steel OR Gun metal (for sizes 50 NB and below)

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LEGEND :

- | | | | |
|------|-----------------------------------|-----|-----------------------------------|
| EDM: | ELECTRONIC DEW METER | FI | FLOW INDICATOR |
| | BALL VALVE | TI | TEMPERATURE INDICATOR |
| | BALL VALVE (NORMALLY CLOSED) | PI | PRESSURE INDICATOR |
| | NON RETURN VALVE | PT | PRESSURE TRANSMITTER |
| | ISOLATION VALVE (NORMALLY CLOSED) | ADT | AUTO DRAIN TRAP SOLENOID OPERATED |
| | SOLENOID OPERATED GLOBE VALVE | | SAFETY VALVE |
| | GATE VALVE | | |

----- AIR LINE

NOTES :

1. THE SCHEMATIC DRAWING SHALL BE READ IN CONJUNCTION WITH TECHNICAL SPECIFICATION.
2. ALL CONTROLS, INTERLOCKS & PROTECTIONS REQUIRE FOR SAFE, RELIABLE AND EFFICIENT OPERATION & MAINTENANCE OF AIR COMPRESSORS & ADP SHALL BE IMPLEMENTED IN CONTROL SYSTEM.
3. ALL IMPORTANT & CRITICAL MEASUREMENTS REQUIRED FOR PROTECTION OF EQUIPMENTS SHALL BE PROVIDED WITH REQUIRED/ADEQUATE
4. VARIOUS FIELD INSTRUMENTS ON AIR _____ HAVE BEEN SHOWN. HOWEVER ANY OTHER ADDITIONAL INSTRUMENTS TO MEET THE SYSTEM REQMT. & FOR SAFE OPERATION OF THE PLANT & EQUIPMENT SHALL BE INCORPORATED IN THE SCHEME BY CONTRACTOR AT NO ADDITIONAL COST TO EMPLOYER.
5. THE SCHEME DOES NOT SHOW THE CIRCUIT, INSTRUMENTS, VALVES ETC. FOR LOADING/ UNLOADING/MODULATION OF COMPRESSORS, REPRESSURISATION/DEPRESSURISATION OF ABSORBER TOWER OF ADP & THE SAME SHALL BE PROVIDED BY RESPECTIVE CONTRACTOR.
6. THE SCHEME HAS BEEN ENVISAGED CONSIDERING HEAT OF COMPRESSION TYPE AIR DRYER (TWIN TOWER TYPE) IN CASE OF ROTARY DRUM TYPE (HOC) AIR DRYER, SCHEME SHALL BE FINALISED DURING DETAILED ENGINEERING

FOR TENDER PURPOSE ONLY



NTPC Limited
(A GOVT. OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)

TITLE **SCHEMATIC DRAWING OF COMPRESSERD AIR SYSTEM**

REV.	DESCRIPTION	DRAWN	DESIGN	CHKD.	WS	PIPING	M	E	C&I	APPD	DATE
A	RELEASED FOR TENDER	TARUN									
					Cleared by						

SIZE	SCALE	DRG.NO.	REV.
A1		6400-001-POM-A-005	A

PART-B
VOLUME – II
CHAPTER – II-E1
GENERAL ELECTRICAL SPECIFICATION

TECHNICAL REQUIREMENTS

1.00.00 GENERAL REQUIREMENTS

1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% shall be considered. The equipment shall operate in a highly polluted environment. However, for equipment in air conditioned areas, design ambient temperature shall be 35 deg.C, if 2x100% air conditioning system is provided.

1.02.00 All equipment shall be suitable for rated frequency of 50Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification. Step-up voltage for the project shall be 33kV.

1.03.00 Contractor shall provide fully compatible electrical system, equipment, accessories and services for the entire station/plant in his scope as well as those specifically required by the Employer.

1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and International Codes & Standards, especially the Indian Statutory Regulations.

1.05.00 The auxiliary AC voltage supply arrangement shall have 33kV, 11 kV [if applicable], 3.3KV [if applicable] and 415V systems. It shall be designed to limit voltage variations as given below under worst operating condition:

- | | | |
|----|-----------------|--------------|
| a) | 33kV | +/-5% |
| b) | 11KV/3.3KV (MV) | +/- 6% |
| c) | 415 V/240 V | +/- 10% |
| d) | 220V/110V | -15% to +10% |

1.06.00 The voltage level for motors shall be as follows:

- | | | | |
|----|-------------------------------|---|---|
| a) | Upto 0.2 KW | : | Single phase 240V AC / 3 phase
415V AC |
| b) | Above 0.2 KW and upto 200 KW | : | 3 phase, 415V AC |
| c) | Above 200 KW and upto 1500 KW | : | 3 phase, 3.3 kV AC |
| d) | Above 1500 KW | : | 11 kV |

The voltage rating of the drives indicated above is for basic guideline. Minor variations in above can be accepted on case to case basis based on techno-economic considerations of the various sub-systems.

Voltage rating for special purpose motors viz, VFD shall be as per manufacturer's standard.

TECHNICAL REQUIREMENTS

- 1.07.00 The preferred AC control supply voltage shall be 110V for all 415 V non breaker controlled feeders. Control supply voltages other than above may be offered by bidder based on the bidder's standard proven practice.
- 1.08.00 The designed fault levels for various voltage levels shall be restricted to the following values:
- 33 kV- 25 kA rms for 1 sec
- 11 kV- 40 kA rms for 1 sec
- 3.3 kV- 40 kA rms for 1 sec
- 415 V- 50kA rms for 1 sec
- 1.09.00 The nominal voltage of main DC system shall be 220V. DC batteries shall be designed for continuous float operation with trickle charge, hence all the associated components like batteries, battery chargers, DC motors, relays, contactors, timers etc shall be suitable for continuous operation at the maximum continuous battery float voltage including suitable temperature correction factors.
- In addition, the bidder may propose 48V or 24V systems as per requirements of control and instrumentation of his equipment and design.
- 1.09.00 The Contractor shall furnish calculations of maximum loading and fault levels under the most onerous conditions for the various equipment/systems as defined elsewhere in the specification to prove adequacy of their parameters. In case any equipment or system is found to be inadequate, it shall be changed/ modified without any additional liability to the Employer.
- 1.10.00 Transformer voltage ratios, taps, impedances and tolerances thereon, shall be so optimized so that the auxiliary system voltages under various loading conditions are always within permissible limits and equipment are not subjected to unacceptable voltages during operation and starting of motors. The vector groups of the transformers shall be so selected that all the buses of particular voltage level have same vector within the plant.
- 1.11.00 In fire hazardous areas like gas/ liquid fuel storage/ handling areas, lighting fixtures, switchgears shall be flame proof.
- 1.12.00 The responsibility of coordination with electrical agencies /TAC/Pollution control board and obtaining all necessary clearances shall be of the contractor.
- 1.13.00 **Provenness Criteria**
- Provenness of the Equipment, system, being offered by the bidder should satisfy the criteria Indicated in the "Provenness criteria" indicated elsewhere in the specification.

2.00.00 SIZING & DESIGN

For Electrical Power Distribution the Station Transformer scheme for the project as conceived by the Employer is indicated in tender SLD. (Refer Single Line Diagram enclosed with the specification documents enlisted in the Part-E, Section-VI of technical specification)

TECHNICAL REQUIREMENTS

2.01.00

Generator

Generator and its excitation system shall have a capability of at least matching the declared maximum continuous rated output of the associated engine at the designed ambient and coolant temperatures at all power factors between 0.85 lagging to 0.95 leading with +3% to -5% frequency variation, terminal voltage variation of +/- 5% and combined voltage & frequency variation of 5%.

Also the generator and its excitation system shall be capable of continuous stable operation without any excessive temperature rise at the peak output of the associated engine and temperature rise shall be lower than those permissible for Thermal Class 130(B) insulation as per IEC-60034.

Generator and its excitation system shall be capable of the flexible (Shift and Cyclic) modes of operation as per requirement specified elsewhere in the specification.

2.02.00

Generator Transformer

The Generator Transformer shall be three phase and shall have On Load Tap Changer with the minimum range of +/- 10% with each step of 1.25%. The rating of the Generator Transformer shall be suitable for continuous stable operation of gen set at the rated nominal output at all power factors.

2.03.00

Generator Busduct

Segregated phase busduct shall be provided for interconnection from the Generator terminal to Generator Transformer. The continuous rating of the Generator busducts shall be selected so that the maximum continuous peak output of the alternator at any ambient temperature between 0 deg C and 50 deg. C can be delivered at the rated power factors and allowable generator voltage variations without exceeding the permissible temperature rise limits as specified for these equipment's.

2.04.00

Auxiliary Transformers

All the transformers shall be sized based on the maximum load expected to be fed by them under most onerous conditions or as per the rating indicated in the Electrical Single Line Diagram.

All Auxiliary transformers (unless their ratings have been indicated in Single line Diagram or for which sizing criteria has been indicated in the specification), shall be sized so as to have 10% margin at design ambient conditions after considering final load requirements, including owner's load (if applicable), at peak load conditions and the No Load Voltage Correction Factor.

Transformer size = The calculated size X no load voltage correction factor (11.5/11, 3.45/3.3, 0.433/0.415).

No Load Voltage Correction Factor (= Transformer No Load voltage/ rated bus Voltage) shall be used for sizing of all transformers.

2.04.01

Adequate number of auxiliary transformers shall be provided to meet the demand on 11kV, 3.3KV [if applicable] and 415V systems under most onerous conditions, with the criteria that

TECHNICAL REQUIREMENTS

each 11kV / 3.3KV / 415 V switchgear / MCC / DB shall be fed by 2x100% transformers / feeders, and these shall be rated to carry the maximum load expected to be imposed.

2.04.02 The overall system shall be such that failure of any one auxiliary transformer, DC battery and Battery charger shall not reduce the capability or affect the safe shut down requirements of the plant.

2.05.00 **MV Switchgears [If applicable for Auxiliary power supply network]**

a) The switchgear boards shall have a single front, single tier, fully compartmentalized, metal enclosed construction complying with clause No. 3.102 of IEC 62271-200, comprising of a row of free-standing floor mounted panels. The Service Class Continuity of Switchgears shall be LSC 2B-PM (as per IEC 62271-200). The Circuit Breakers / Contactors / Bus VTs shall be mounted on withdraw able trucks which shall roll out horizontally from service position to isolated position. The Switchgear shall have an Internal Arc Classification of IAC FLR 40kA 1 sec. The Circuit Breakers / Contactors shall be of Vacuum type.

b) All MV incomers from transformers and ties between switchgears shall be through bus ducts or adequately rated cables. 11kV and 3.3 kV incomers from transformers to switchgear and ties between switchgears shall be through bus ducts for main plant. In the offsite areas, MV incomers from transformers to switchgear & ties between switchgears shall be through bus ducts or adequately rated cables.

c) The sizing Criteria for a Typical MV Switchboard shall be determined by the size of the transformer feeding the board. As a design Philosophy the Board continuous Current shall be selected as $(1.1) * (\text{Full load current at rated voltage on the Transformer's secondary})$ at 50 deg. C Ambient.

d) The various outgoing feeders shall be Feeders for Motors, Auxiliary Transformers, Tie feeders and Supply feeders. While sizing the outgoing feeder the rating is calculated based on the following:

Motor Feeder: kW Rating/ [System Vol * 1.732 * (Eff) *(Pf)] *1.1 (at least)

Transformer feeder: Transformer kVA/ primary [Voltage * 1.732] *1.1 (at least)

Tie feeder: As per system requirement

Incomer feeders: Generally same as the Board rating

Bus Couplers: Generally, 2/3 of the Incomer Feeder rating.

e) Standard MV Switchgear Modules and their Selection Criteria

MV feeders shall be categorized into standard Modules. The module defines the feeder type, Protections, Feeder schematics and metering and monitoring requirements. The Standard Modules are listed in table below:

S No	Module Type	Application	Applicability
1	DA	Motor Feeder	MV Motor Feeders < 2 MW
2	DAF	Motor Feeder with Differential Protections	MV Motor Feeders > 2 MW

TECHNICAL REQUIREMENTS

3	DB	Transformer Feeder	Transformer feeder < 5 MVA
4	DBF	Transformer Feeder with Differential Protections	Transformer feeder > 5 MVA
5	DC	Incomer Feeder	MV Incomer Module
6	DD	Bus Coupler Feeder	Bus Coupler Module for MV Boards
7	DE (Outgoing)	Tie Feeder	Outgoing feeders except to transformers
8	DB1 (< 5MVA) DBF1 (> 5MVA)	Standalone Transformer feeders	Standalone panels with both incoming & outgoing cables for remote locations

2.06.00

LV Switchgears

- a) All switchboards shall be of double front, draw out, complete closed-door operation, metal enclosed, indoor, floor-mounted, free-standing type of bolted design. Entire bus bar system shall be insulated with PVC sleeves (UL 224). Cable terminations located in cable alley shall be designed to meet the Form IVb Type 7 (as per IEC 60439) for safety purpose.
- b) All ACDBs, DCDBs, Solenoid Valve DBs and MCCs located on Stacker Reclaimer, Paddle feeders and Travelling trippers shall be of Fixed Module type. All 415V Circuit breaker modules and other MCC modules shall be fully draw out type.
- c) The Circuit Breakers / Contactors shall be of air break type & should conform to the requirements of IS / IEC 60947.
- d) MPCB/MCCB shall be provided for supply feeders of current rating upto 16 Amps. MCCB shall be provided for all supply feeders of current rating above 16 Amp and including 400A. Air circuit breakers shall be provided for supply feeders above 400 Amps.
- e) Bottom most operable handle should be at least 300mm above FFL. Shrouding of at least 3mm thickness to be provided below the hanging portion of vertical busbars. Half width module
- f) For protection of motors below 30kW, MPCB(only Short-circuit release) and Intelligent motor controller(IMC) with current sensing module shall be provided and for motors from 30kW and below 90kW, MCCB and Intelligent motor controller(IMC) with current & voltage sensing module shall be provided. Motor feeders below 90kW (upto 160kW for CHP conveyor motors) shall be contactor controlled. Contactors shall be of 250% of motor FLC for fan and compressor application and 200% of motor FLC for other application. The motor feeders for 90kW & above shall be Air Circuit Breaker controlled. All moving and fixed contacts of each draw-out modules must be of rating more than 150% of MCCB/MPCB mounted inside the module. Each phase of vertical busbars shall be separated by phase barrier.

**MOTOR FEEDERS BELOW 90KW SHALL BE CONTACTOR CONTROLLED.
THE MOTOR FEEDERS FOR 90KW & ABOVE SHALL BE AIR CIRCUIT
BREAKER CONTROLLED.**

TECHNICAL REQUIREMENTS

- g) For 415V system, busduct assemblies shall be provided for incoming connection from transformers to the switchboard and interconnecting sections between switchboards wherever transformer rating is 1000KVA or above.
- h) The sizing of LV boards shall be dependent on conditions such as total load connected to a board, diversity factors for various loads connected, Fault Level and Voltage Regulation Considerations, etc.
- i) As far as practicable the system shall provide segregated supplies to main and standby auxiliaries so that the failure of supply to main auxiliary shall in no way jeopardize the standby auxiliary feed. Automatic changeover at critical switchgear / MCC sections shall be provided as necessary to prevent the loss of a unit or to ensure the equipment safety.
- j) All indoor floor mounted switchgear (PCCs/MCCs), ACDBs of busbar rating more than or equal to 100 A and DCDBs shall require to qualify the Sub-QR clause of LT switchgear.

h) Sizing of LT boards

- a) Input kVA for a Drive = (Rating in kW X Load Factor) / (Efficiency X Power Factor) where values of load factor, power factor and efficiency are defined below:

Load (service) factor for 415 V loads is taken as 0.855 for continuous and 0.1 for intermittent loads.

Power factor 415 V Uni-Directional drives is taken as 0.8 and efficiency as 0.85

Power factor of 415 V bidirectional drive loads is taken as 0.65 and efficiency as 0.8 for motor rating less than 15 kW. For motor ratings of 15 kW and above the corresponding values are 0.75 and 0.8.

- b) The Finally selected Busbar ratings for Switchboards, MCCs, ACDBs and Busducts shall include a 10% margin over the transformer full load current/calculated values whichever is higher.
- c) Lighting load shall be considered with a service factor of 70% of the associated lighting transformer size, on each section of main switchgears with incomer from transformer.
- d) A spare capacity of about 10 % shall be kept for addition of loads during detail engineering as many of the LT loads cannot be predicted during the Rating selection of the Board.
- e) Busbar Ratings of Valve / Damper ACDBs shall be derived by addition of 5% of the total kVA load connected and the rating of the largest Valve / Damper connected.
- f) Welding sockets shall be connected from Welding DBs, which shall be fed through 1X100% Welding transformers.
- g) ESP consumption for 100% BMCR operation shall be considered and further this load shall be uniformly divided among main ESP Switchgears.

i) Sizing of Offsite Boards

- 1. The loads for mechanical auxiliary systems shall be met by auxiliary transformers based on the criteria that each switchgear/MCC/Distribution board shall be fed either by 2x100% or 3x50% transformers/feeders and, these shall be rated to carry the maximum load expected to be imposed. Each of the above boards shall be sectionalized.

TECHNICAL REQUIREMENTS

2. The sizing of Unit Emergency boards shall be in according to the DG rating. The Emergency board shall have tie to both sections of Unit Service Switchgear for catering unit loads in Blackout Conditions.
3. For Main Plant (TG & SG areas) and Service Building, each Lighting DB shall have 1X100% transformer. For all other offsite areas, each Lighting DB shall have 2X100% transformers.

j) Layout Criteria

The switchboards can be split into two sections based on layout constraints in case of long switchboards to optimize Switchgear room layouts. The two sections of the split shall be connected by Busduct / Cable as per layout requirements.

k) Spare capacity and Future Requirements

Each of the LV switchboards shall be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with spare feeders / modules as specified in relevant clause of Part-A of Technical Specification.

l) Standardization

It shall be preferred to have all LV Switchboards for the entire plant from One / Two manufacturer(s) from maintainability and spares management point of view.

It shall be preferred to follow a standardization of Terminal Numbers across all LV Modules for ease of Interconnection and maintenance.

m) Plant control cable Interconnections

Control cable interconnections between switchgears and transformer marshalling boxes, switchgears and motor terminal boxes / push button stations, and between various switchgears shall be in the contractor's scope.

- a) Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5 mm² ,14CX1.5 mm²
- b) Cable size for motor space heater application shall be 2CX2.5 mm²
- c) Interconnections for Current Transformer terminals shall use two cores of 1.5mm² size per phase
- d) Core identification shall be using core color for up to 5-core cable and core number for cable with more than 5 cores.
- e) Separate control cables shall be used for current transformers
- f) At least one spare core shall be made available in each of the control cable

3.07.00

Numerical Relay Networking

The Numerical Relay Network system shall be an integrated system for protection, control (except motor feeders), measurement and monitoring of all MV & LV circuit breakers / vacuum contactors in the Auxiliary Power Supply network. The system shall have communicable numerical relays complying with IEC-61850 on all feeders which shall be networked on Ethernet to form a distributed dual ring architecture to be connected to

TECHNICAL REQUIREMENTS

DDCMIS for monitoring & data acquisition of all MV & LV circuit breakers/ MV vacuum contactors on IEC 61850 protocol.

The circuit breaker will normally be controlled from remote control panels (DDCMIS) through closing and shunt trip coils. All the protective relays associated with the Circuit breaker modules shall be of Numerical communicable type for Protection, Control, Metering and Status monitoring. All the numerical relays shall have communications on three ports, local front port communication to laptop and dual ports on IEC 61850 to communicate with the DCS through LAN. The auxiliary contacts of the MCCB shall be fed to the digital inputs available in the numerical relays of Incomer / bus coupler / motor circuit breaker feeders or 61850 Compatible IO Modules, for integration into the numerical relay network/ DCS.

2.07.00

Control Philosophy

- (a) All the 11 KV/ 3.3 KV & LT Incomers, Bus Ties, Bus couplers, Transformer Breaker feeders shall be controlled from DDCMIS through hard-wired interlocks & Close/Trip commands.
- (b) All MV breaker/Vacuum contactor controlled, and LT Breaker controlled motor feeders shall be controlled from the DDCMIS through hard-wired interlocks & Close/Trip commands.
- (c) All LT Contactor controlled motor/heater feeders shall be controlled from DDCMIS through Intelligent Motor Controller (IMC) on profibus DP communication.
- (d) All 33kV breakers shall be controlled from Substation Automation System.

2.08.00

Cables and Bus Ducts

The minimum rating of cable/ bus ducts shall meet the following criteria:

All the cables and bus ducts feeding switchboards from transformers shall be sized based on transformer rating. All the cables and bus ducts feeding transformers shall be sized based on current ratings of transformer at the minimum voltage tap of the transformer. All other cables/bus-ducts shall be sized based on the load demand under most onerous conditions.

Cables shall be selected so as to limit maximum voltage drop at equipment terminals during normal operation and starting conditions well within permissible values. Cables shall be derated for the site ambient and ground temperatures, grouping and soil resistivity and cable laying configuration.

All HT cables shall be of unearthed grade. Bidder shall furnish detailed cable selection/sizing criteria for Employer's approval.

2.09.00

Earthing & Lightning Protection System The earthing system for plant shall be designed for a life expectancy of at least forty (40) years, for a system fault current of 40 kA for 1.0 sec. The minimum rate of corrosion of steel (over calculated diameter) for selection of earthing conductor shall be 0.12mm per year.

TECHNICAL REQUIREMENTS

Grounding and lightning protection for the entire power plant, switchyard and other areas or buildings covered in the specification shall be provided in accordance with IS 3043, IEC 62305, IEEE 80 and IEEE 665.

2.10.00

D.C. Systems

Complete DC system, comprising of batteries, battery charges, relays, contactors, timers etc shall be suitable for continuous operation at the maximum continuous float voltage including suitable temperature correction factors.

The battery sizing shall be done based on different types of continuous and intermittent loads including motor starting (wherever applicable) under complete blackout condition, for the duration specified so as to meet the system requirement (30 minutes minimum). All intermittent loads shall be considered with minimum 1 minute duration. The battery shall be sized considering a minimum electrolyte temperature of 15Deg C along with temperature correction factors as per relevant standard. An ageing factor of 1.25 shall be considered in case of Ni-Cd batteries. The no. of cells and end cell voltage shall be considered based on the minimum and maximum voltage window and cable drop etc. as per system requirement.

Each system shall comprise of two nos. of batteries and two nos. of float-cum-boost chargers each rated for 100% capacity. DC scheme shall ensure that each critical consumer is fed from two different bus sections. DCDBs shall provide adequate number of feeders on each section.

Boost/ fast charging time shall be as per worst operating condition and would satisfy technical requirements recommended by battery manufacturer. Each battery charger must be capable of supplying all the continuous D.C. loads (fed through both section of DCDB) plus the trickle charging current of both the batteries. In addition, each charger must have sufficient surplus capacity for running of the largest D.C auxiliary so that the battery is not drained during testing of the same. Battery charger should also be capable of boost/ fast charge the battery from completely discharged condition to fully charged condition without imposing any limitations under worse operating conditions. Battery size shall be as per the following:

DC Voltage	Load	Minimum Battery Bank Rating
220 V	supply total DC load of the associated area at an acceptable voltage for at least 30 minutes including DC Lighting	150AH for lead acid Plante type /90 AH for Ni-Cd High Discharge (KPH) type batteries [MINIMUM] Charger Rating 40AMP [MINIMUM]

2.08.00

Diesel Generator Set

Diesel Generating set(s) shall be provided as per system requirement for black start and for safe shut down of the plant under emergency conditions and in case of total power failure. DG set(s) shall be capable of meeting 100 % of essential load requirements including starting of the largest motor (DOL) with other loads connected without exceeding the permissible starting voltage drop.

TECHNICAL REQUIREMENTS

2.09.00 PLC based control system wherever envisaged shall be provided with 100% redundancy i.e. hot standby.

3.00.00 The plant shall be designed to operate in islanding mode of operation by tripping all the lines and generators except for one pre-selected unit, which shall run with the available plant load under such condition.

4.00.00 NEUTRAL GROUNDING

4.01.00 Neutral earthing equipment shall be designed duly taking into account the maximum permissible operating voltage of the generator, voltage rise on load throw off (subsequent to detection of earth fault) field suppression time, ferro-resonance, etc. The generator shall be grounded through distribution transformer with secondary loading resistor, limiting the earth fault current to not less than capacitive current so as to restrict the over voltages caused due to capacitive currents. The neutral earthing equipment shall be rated to carry this current for at least 5 minutes considering the Generator Terminal Voltage under maximum field forcing conditions.

4.02.00 11KV/3.3KV system [if applicable] earthing shall be low resistance earthed type to limit earth fault current to 600A. The resistor shall be rated to carry this current at least for 10 seconds.

4.03.00 Neutrals of Generator Transformers (on 33kV side), and LV Side of all LT Transformers (415V) shall be solidly earthed through bolted links.

4.04.00 220V DC system shall be kept ungrounded.

4.05.00 Diesel generator shall also be kept ungrounded (earthing through PT).

5.00.00 INSULATION LEVEL

The insulation level for the transformer windings and bushings shall be as follows:

Highest System Voltage (kVp)	WINDING		BUSHING	
	Rated Power Freq. withstand Voltage (kVrms)	Rated lightning impulse freq. withstand voltage (kVp)	Rated Power withstand voltage (kV rms)	Rated lightning withstand voltage
0.433 KV	3	-	3	-
3.6 kV	10	40	11	40
7.2 kV	20	60	22	60
12 kV	28	75	30	75

TECHNICAL REQUIREMENTS

17.5 kV	38	95	42	95
24kV	50	125	55	125
36kV	70	170	77	170

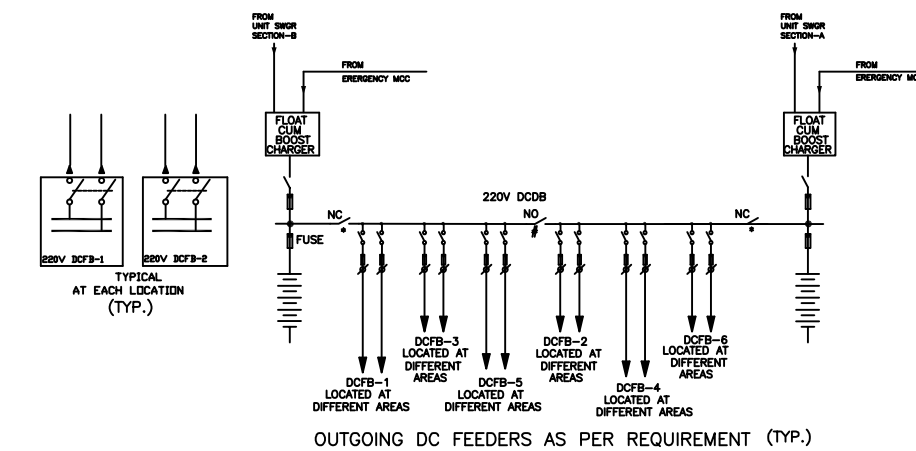
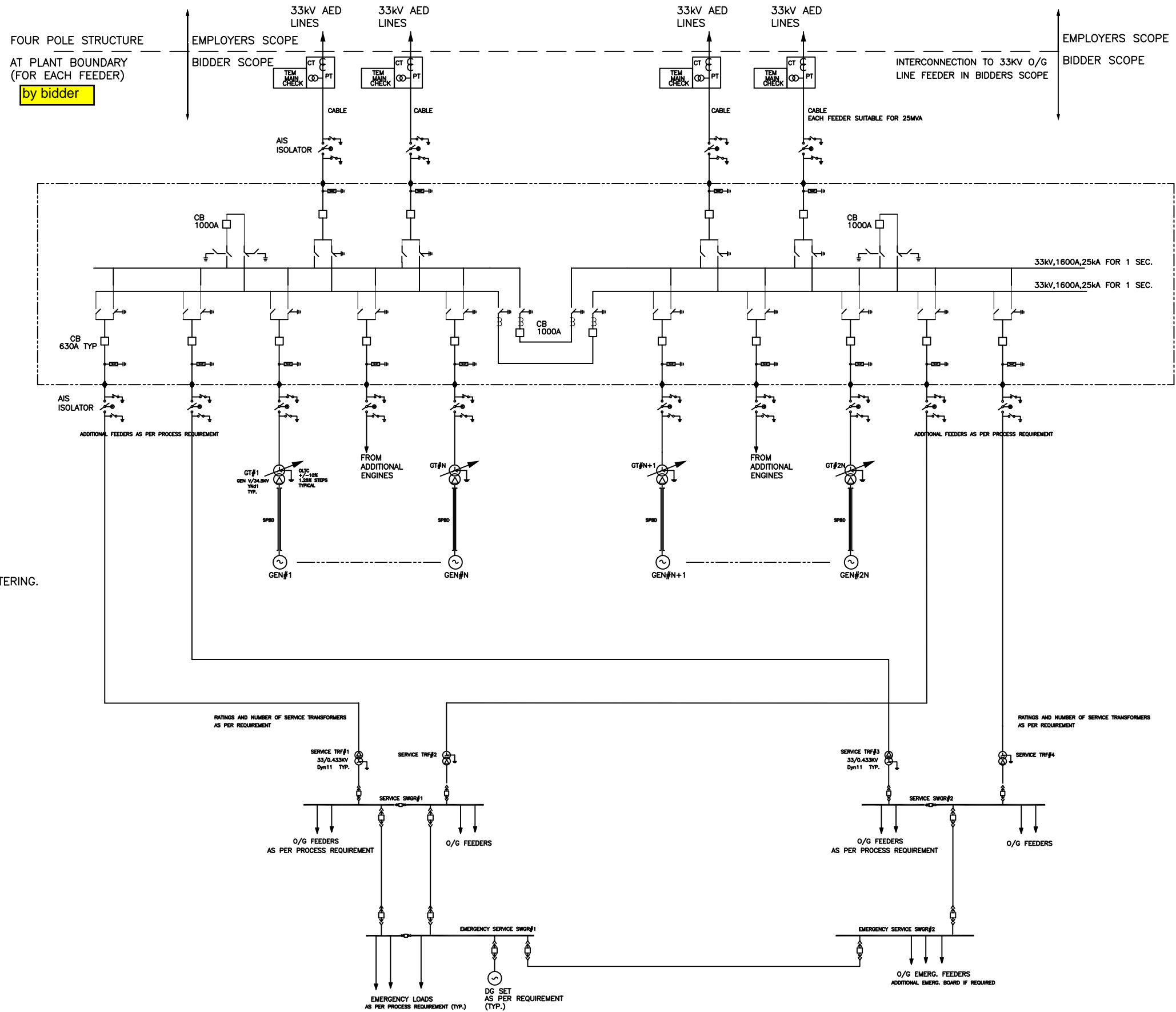
6.00.00 FAULT LEVEL

Equipment through fault withstand capabilities under worst operating conditions duly taking into account negative tolerances on transformer and maximum fault levels of source etc. shall be as follows :



- | | | |
|------|---|---|
| i) | All transformers | - 2 seconds |
| ii) | 11 kV/3.3 KV busduct | - 1 second |
| iii) | Switchgears/33kV GIS | - 1 second |
| iv) | Cables to the feeders protected by breakers
0.12 | Main protection fault clearing time with
seconds minimum |
| v) | Cables of all other feeders | As per fuse operating time |
| vi) | 33kV, 11KV & 3.3KV cable screen | - 2 seconds for the adopted ground fault current |

GENERAL NOTES:

- THE SELECTION OF LT OUTGOING FEEDERS(DRAW OUT TYPE) SHALL BE AS INDICATED HEREUNDER:
(i) UPTO 400 A – MCCB
(ii) ABOVE 400 A – BREAKER
- CONTROL AND PROTECTION SUPPLIES FOR ALL SWITCHGEARS/ DBS/CONTROL PANELS SHALL BE FED FROM TWO DIFFERENT SOURCES/DIFFERENT SECTIONS.
- STANDARD LT TRANSFORMER RATINGS TO BE EMPLOYED ARE 2000, 1600,1000,630KVA
- WHEREVER NO RATING HAS BEEN INDICATED, SIZING SHALL BE CARRIED OUT AS PER SYSTEM REQUIREMENT AND FINAL DRIVE LIST. FINAL FEEDING ARRANGEMENT TO BE DECIDED DURING DETAILED ENGINEERING AS PER SIZING CRITERIA SPECIFIED IN THE TECHNICAL SPECIFICATION.
- NUMBER AND MW/MVA RATING OF GEN-GT SETS SHALL BE SELECTED BY BIDDER AS PER REQUIREMENTS OF TECHNICAL SPECIFICATIONS.
- NUMBER OF MOTORS/FEEDERS SHOWN IN THE SLD IS TYPICAL AND FEEDING ARRANGEMENT SHOWN AT VARIOUS LOAD CENTERS IS INDICATIVE IN NATURE SHOWING THE FUNCTIONAL REQUIREMENTS.
- BIDDER SHALL PROVIDE DC SYSTEM OF ADEQUATE CAPACITY FOR MEETING DC LOADS FOR THE PLANT.
- MINIMUM ONE NUMBER DG SET COMMON FOR ENTIRE PLANT SHALL BE PROVIDED BY THE BIDDER FOR MEETING THE EMERGENCY PROCESS LOADS AND SAFE SHUTDOWN OF THE PLANT.
- ALL BATTERY CHARGERS SHALL HAVE 2 INPUT SUPPLIES ALONG WITH SUITABLE AUTOMATIC CHANGEOVER BETWEEN THE SOURCES.
- LOCATION OF TARIFF ENERGY METERS SHOWN IS TENTATIVE AND MAY CHANGE AS PER THE DISCOM REGULATION.
- ROOFTOP SOLAR GENERATION SHALL BE INTEGRATED IN NEARBY SERVICE SWITCHGEAR HAVING ADEQUATE CAPACITY. EACH ROOFTOP SOLAR FEEDER SHALL HAVE 0.5CLASS METERING.



FOR TENDER PURPOSE ONLY

 PROJECT
ANDAMAN & NICOBAR GAS POWER PROJECT (50MW)

A	FOR TENDER PURPOSE ONLY	ZSN	ABK	ABK	KRK	22.10.24	TITLE SINGLE LINE DIAGRAM			
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	APPD	DATE	SIZE A3	SCALE NTS	DRAWING NO. 6400-999-POE-J-001	REV. NO. A

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LEGEND:-

EM* - ABT COMPLIANT ENERGY METER

If applicable
 51ET - O/C PROT. FOR EXCITATION TRF.
 87ET - EXCITATION TRF. DIFF. PROT.

PROTECTIONS TO BE CONFIGURED IN GP1,GP2:

GRP1/2:

- 87G - GENERATOR DIFF. PROT.
- 64G - 95% STATOR E/F PROT.
- 95* - INTERTURN FAULT PROT.
- 40G - FIELD FAILURE PROT.
- 21G - B/U IMPD. PROT.
- 46G - NEGATIVE SEQ. PROT.
- 37G - LOW FORWARD PROT
- 32G - REV. POWER PROT
- 64F* - ROTOR EARTH FAULT PROT.
- 50GDM - ACCIDENTAL BACK ENERGIZATION
- 24G - GEN OVERFLUXING PROT.
- 98G - GEN POLE SLIPPING PROT.
- 51V - VOLTAGE RESTRAINED OVERCURRENT (51V) PROT.
- 59G - OVER VOLT PROT.
- 81G - UNDER FREQUENCY PROT.
- 60 - VT FUSEFAIL PROT.

* - CAN BE CONFIGURED IN ANY OF THE GRP RELAYS

87BB- 33KV BUSBAR PROTECTION (LOW IMP. DIFF.)

50ZCB - GEN. CIRCUIT BREAKER FAILURE PROT.(INBUILT IN BB PROT.)

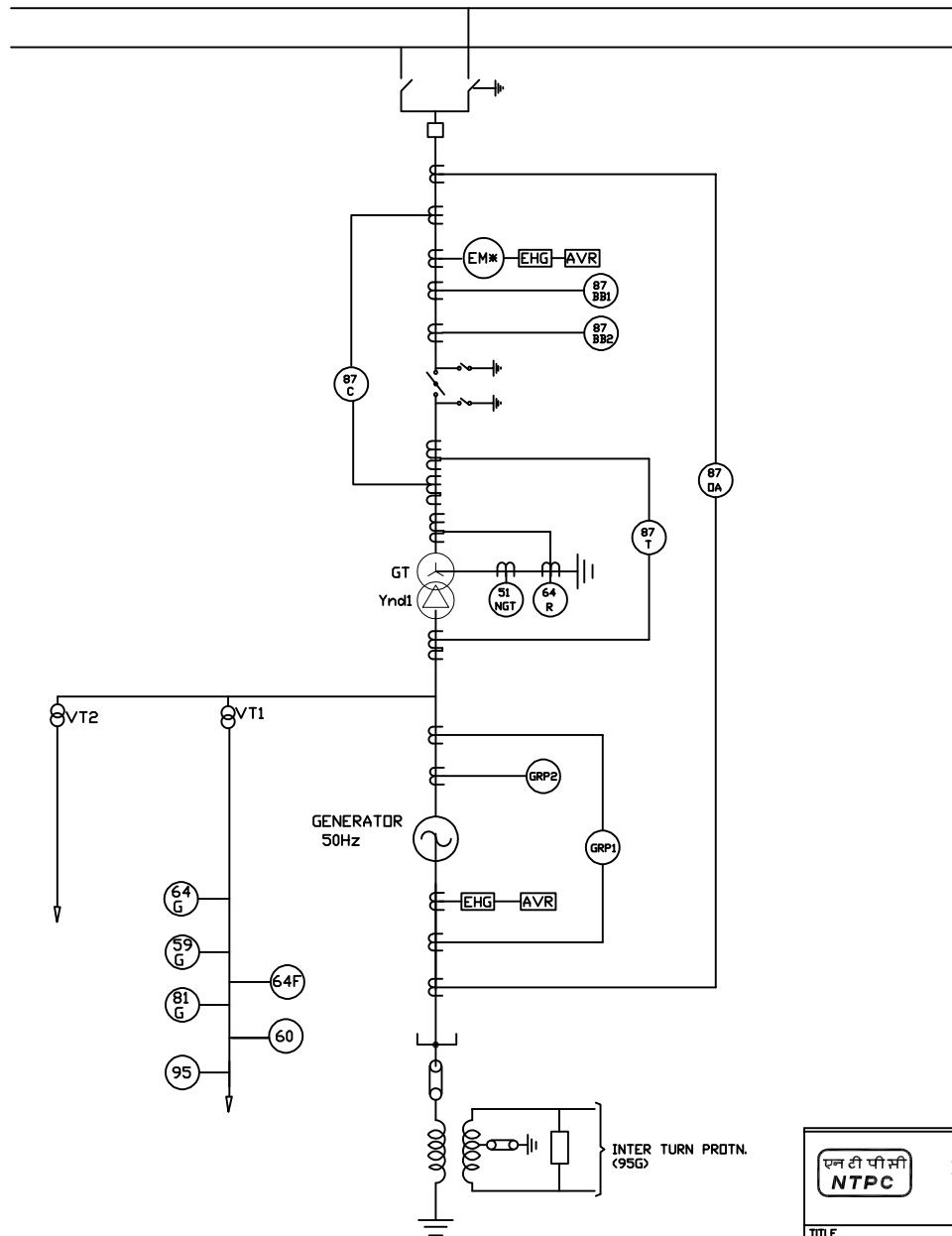
87C- CABLE DIFFERENTIAL

87T- GT DIFFERENTIAL

870A- OVERALL DIFF.

51NGT- BACKUP EARTH FAULT.

64R- GT REF PROT.



FOR TENDER PURPOSE ONLY

		NTPC Ltd. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION	
TITLE			
ANDAMAN AND NICOBAR GAS POWER PROJECT			
TITLE			
GENERATOR RELAY PANEL PROTECTION SLD			
DESIGN.	CHKD.	APPRD.	DATED
SIZE	SCALE	DRAWING NO.	
	NTS	6400-999-POE-J-002	
			2

NOTE:-

1. THE CT/VT CONNECTION TO VARIOUS RELAYS ARE INDICATIVE.
2. FOR 33 KV SWITCHGEAR CBS, LBB, PROT SHALL BE COVERED IN BB PROT. RELAY.
3. FOR 33 KV SWITCHGEAR CBS, CT FOR BB PROTECTION MUST BE PROVIDED IN EACH BAY.
4. PROTECTION DRAWINGS SHALL BE READ IN CONJUNCTION WITH TECHNICAL SPECIFICATION REQUIREMENT.

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PART-B
VOLUME – II
CHAPTER – II-E2
GENERATOR & AUXILIARIES

TECHNICAL REQUIREMENTS

A. GENERATOR & AUXILIARIES

- 1.01.00 Contractor shall provide fully compatible electrical system, equipment, accessories and services.
- 1.02.00 Standard : IEC-60034
- 1.03.00 Paint shade : RAL 5012
- 1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.
- 2.00.00 TYPE AND RATING**
- 2.01.00 Type : Three phase, horizontal mounted, indoor installed, Thermal Class 155 (F) for Stator and Rotor winding insulation, cylindrical rotor type conforming to IEC-60034.
- 2.02.00 GENERATOR RATING**
- 2.02.01 Generator and its excitation system shall have a capability at least matching the declared maximum continuous rated output of the associated engine.
- 2.02.02 Also the generator and its excitation system shall be capable of continuous stable operation without any excessive temperature rise at the peak output of the associated engine and temperature rise shall be lower than those permissible for Thermal Class 155 (F) insulation as per IEC-60034.
- 2.02.03 Rated Parameters:
- | | |
|-----------------|----------------|
| 1. Voltage | 11 KV |
| 2. Power Factor | 0.80 (lagging) |
| 3. Frequency | 50 Hz |
- 3.00.00 OPERATIONAL REQUIREMENTS FOR GENERATOR**
- | | |
|--|---|
| 1. Voltage Variation | +/-5% continuously at rated power factor. |
| 2. Frequency Variation | 47.5 Hz to 51.5 Hz. |
| 3. Combined voltage and frequency variation | 5% |
| 4. Operation under unbalanced load | As specified in IEC 60034-1 |
| 5. Operation under unsymmetrical short circuit | Negative sequence current I_2 expressed in per unit of rated current for a duration of 't' second such that the value of $I_2^2 t$ shall comply to IEC 60034-1 |
| 6. Voltage Wave form | The Total Harmonic Distortion (T.H.D) shall be within the limit specified in IEC 60034-1. |
| 7. Short Circuit withstanding capacity | Capable of withstanding of 3 phase short circuit at the generator terminals when operating at rated MVA and power factor with 5 % over voltage for a period of not less than 3 seconds. |
| 8. Impulse level & Surge | To be suitable for test voltage of 4U+5 KV. |

TECHNICAL REQUIREMENTS

Protection (where U is rated line to line voltage in KV).
Lightning arrestor and surge capacitors of suitable rating shall be provided for the protection of generator winding.

4.00.00 CONSTRUCTIONAL FEATURES

1) General

- a) All components of the generator to be designed to avoid resonance at any of the frequency in the operating range and their multiples.
- b) Earthing brushes shall be provided. It should be possible to increase the brush pressure while generator is working. In case any other arrangement for shaft earthing offered by Contractor, the same shall be accepted. Rotor earth fault monitoring shall be provided.
- c) Suitable generator drying arrangement shall be provided.

2) Generator Instrumentation

The following minimum instruments shall be provided for each generator. For the requirements regarding type, make etc. of instruments and sensors, refer stipulations under relevant Sub-sections of Control & Instrumentation.

A) Resistance temperature detectors (RTD)

a) Temperature Detectors

Resistance temperature detectors (RTD) to be duplex four / three wire type 100 ohms platinum, calibrated as per DIN standard and located at points where highest temperature is likely to occur during operation. In case simplex RTDs are provided they shall be double in quantity of those specified as below.

- b) Number and location
 - i) Atleast Six (6) detectors-two (2) per phase uniformly distributed along the circumference of the stator and located at the hottest possible zones.
 - ii) Atleast Two (2) detectors per bearing for measurement of temperature.
- c) Interface All the above temperature measurement devices shall be connected to DDCMIS.

5.00.00 GENERATOR EXCITATION SYSTEM

5.01.00 A complete generator excitation and voltage regulating system shall be provided with the generator. The Generator excitation system shall be standalone system. All panels of excitation system shall be in single suite. It shall have provision of connection to Generator MMI through network interface. However it shall also be able to operate the Generator excitation system without this interface.

5.02.00 Characteristics The excitation system shall have matching characteristics suitable for satisfactory parallel operation with other generators in the plant.

5.03.00 Fail safe requirement The various change over relays and other equipment associated with supply system other than AVR control supply, electronic circuits of either channel

TECHNICAL REQUIREMENTS

		etc., shall be such that the loss of their control supply does not lead to the excitation system outage.
5.04.00	Equipment design & sizing criteria	
5.04.01	Redundancy	The excitation system shall have two (2x100%) AVR channels including complete independent power supplies and controls. Each channel shall be equipped for 'Auto Operation' with the facility for selecting either channel in 'Auto' or 'Manual' mode.
5.04.02	Margin	Each excitation system channel shall be designed to continuously carry currents of at least 10% above the field current requirement at generator MCR condition.
5.05.00	Excitation system ceiling voltage	> 1.5 times rated load excitation voltage.
5.06.00	Technical features	Voltage regulator shall have the provision of limiters to ensure the machine operation within the defined capability limits.
5.07.00		In addition, one (1) 15 inches or more laptop shall also be supplied per unit to facilitate programming of DAVR and downloading of records locally. Suitable communication port, cables, interfacing software etc shall be provided. The configuration of the laptop shall be finalized during detailed engineering. The requisite license/ dongles shall be provided.
6.00.00	TYPE TESTS AND TEST REPORTS	
	(a.)	All equipment to be supplied shall be of type tested design. The Contractor shall submit for Owner's approval the reports of all the type tests (as listed out in relevant clauses) carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
	(b.)	In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost either at third party lab or in presence of client/owners' representative and submit the reports for approval. The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days' notice shall be given by the contractor.
	(c.)	All routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
	(d.)	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.
6.01.00	LIST OF TYPE TESTS	
		Type test report for the following test shall be furnished:
6.01.01	GENERATOR	
	a)	Instantaneous short circuit test to determine transient and sub-transient reactance parameters and to ensure stability of winding during sudden short circuit condition
	b)	Determination of negative sequence and zero sequence reactance and resistance
	c)	Determination of voltage waveform factor and Total Harmonic Distortion factor
	d)	Short circuit heat run test
6.01.02	Excitation system	

TECHNICAL REQUIREMENTS

- (a) Exciter (If applicable)
Temperature rise test at peak rating of excitation system. Ceiling duty condition shall also be demonstrated
- (b) Converter Assembly
Temperature rise test at peak rating of excitation system. Ceiling duty condition shall also be demonstrated.
- (c) Input and output surge withstand capability test:
The Oscillatory SWC tests shall be conducted as per ANSI / IEEE C37.90.1-2002 and/or
The Fast transient SWC tests shall be conducted as per ANSI / IEEE C37.90.1-2002 / IEC 60255-22-04-2008.

PART-B
VOLUME – II
CHAPTER – II-E3
BUS DUCTS

TECHNICAL REQUIREMENTS

BUS DUCTS

1.00.00 CODES AND STANDARDS

ANSI	C 37.20, 37.23,37.24
BS	3815, 3816
IS	2544, 2705, 3070, 3156, 5082, 8084, 9431
IEEE	298, 32

2.00.00 TYPE

2.01.00 MV BUSDUCT

Metal enclosed, phase segregated and natural air cooled.

3.00.00 RATING

MV Busduct ratings shall be as per system requirements.

3.01.00 MV BUSDUCT

Rated Voltage Equal to Max. continuous system voltage

Rated Current As per system requirement.

4.00.00 TEMPERATURE LIMITS (considering effect of solar radiations)

MV Busduct

Conductor/ Joints : 105 deg. C for silver plated joints,
90 deg. C for other joints

Enclosure : 80 deg. C

For outdoor portion the above limits shall be reduced to 97.5 deg. C, 82.5 deg. C and 72.5 deg. C respectively.

5.00.00 FUNCTION

5.01.00 Bus Ducts

MV bus ducts shall be provided for Interconnection between Generators, transformers and switchgears.

5.02.00 Bus Duct routings below ground level shall not be provided.

6.00.00 OPERATIONAL REQUIREMENTS

6.01.00 MV Bus Ducts

6.01.01 Adequately sized galvanised mild steel earthbar shall run along the length of busduct. Each enclosure section to be connected to the earthbar at both ends. Both ends of earthbar to be connected to plant earthmat.

6.01.02 Inspection openings / split covers with reliable sealing with neoprene gasket in grooves shall be provided for allowing easy access for installation and inspection of insulators, disconnecting links terminations and CTs.

TECHNICAL REQUIREMENTS

7.00.00 DESIGN AND CONSTRUCTIONAL REQUIREMENTS

7.01.00 MV Busducts

7.01.01 Enclosure

Aluminum alloy with minimum thickness of 3mm, naturally cooled. Each section shall be welded construction. Sections may be joined through bolted connections. Suitable rain hoods for outdoor joints shall be provided. Adequate number of thermostat controlled space heaters or any other proven arrangement to prevent condensation to be provided.

7.01.02 Phase barriers

MV busduct phase barriers shall be made of Aluminum alloy of minimum thickness of 3.0 mm.

7.01.03 Conductor

Shall be of high conductivity, aluminum alloy or Copper, sections shall be welded or bolted.

7.01.04 Flexibles for Conductors to be provided at all equipment termination and in bus duct run to accommodate thermal expansion / contraction, vibration and misalignment as also for providing adequate clearances for independently testing the equipment being connected.

7.01.05 The busduct shall be provided with adequate number of thermostatically controlled space heaters of adequate capacity to maintain the internal temperature above the dew point to prevent moisture condensation within the busduct. Space heaters shall be rated for 240V, single phase, 50Hz AC supply.

7.01.06 Joints

Shall be bolted and flexible joints for conductor and enclosures.

7.01.07 Painting

Conductors and inside surface of enclosures to be treated with mat black paint for efficient heat dissipation

7.01.08 Bimetallic connectors

Shall be provided in case equipment terminals and material of bus conductor are different for the non silver plated joints.

7.01.09 Insulators

Glazed porcelain/ high strength epoxy cast resin with a minimum creepage distance of 20 mm/kV. The insulators shall be designed and mounted to facilitate easy inspection, removal & inspection along with provision of conductor fastening by fixed and sliding joints.

7.01.10 Seal Off Bushing

Shall be provided at terminations and wall crossing and at each of the switchgear terminations.

7.01.11 Wall Frame Assembly

Shall be provided wherever bus-duct penetrates plant walls Expansion bellows
Neoprene or metallic expansion bellows shall be provided on enclosures for thermal expansion, vibrations and misalignment. To be provided at

TECHNICAL REQUIREMENTS

terminations and as required.

7.01.12 Enclosure supports

Shall be provided Hot dip galvanised mild steel support structures to withstand normal operation, vibration, thermal expansion and short circuit forces. Types of support structure for MV busduct identified in Annexure to this section.

7.01.13 Minimum clearances for MV busduct shall be :

Phase to phase	:	100 mm (for 6.6KV)
		130 mm (for 11KV)
		70 mm (for 3.3 kV)
Phase to earth	:	90 mm (for 6.6KV)
		120 mm (for 11KV)
		60 mm (for 3.3 kV)

7.01.14 Openings covered with louvers backed up with removable dust filters shall be provided at appropriate location to enable the MV busduct enclosure to breathe in a manner so that possibility of condensation is minimised.

7.01.15 Earthing of Enclosure

Adequately sized Galvanised mild steel earth bar shall run along the length of busduct. Each enclosure section shall be connected to the earth bar at both ends. Both ends of earth bar shall be connected to the plant earth mat.

8.00.00 **Current Transformer, Voltage Transformer and Surge protection Cubicles**

- a) The current transformers shall be epoxy cast-resin. Mounting arrangement of CT shall be so designed so as to avoid equalizing connections between live conductor and CT inner surface. All measuring CTs shall be 0.2 accuracy class and ABT type metering CT shall be 0.2s accuracy class. Protection CTs shall be PS/5P20 as applicable.
- b) CT secondary leads shall be brought out through non-magnetic metallic conduits to a marshalling box (MB) with degree of protection IP-55 (IS:13947 Pt.1). The MB shall be provided with removable aluminum gland plant. The facility for shorting and grounding shall be provided at the terminal blocks. PTs shall be dual accuracy class (3P/0.2)
- c) The V.T and S.P cubicles for each phases shall be metal clad, dust and vermin proof, free standing, dead front assemblies housing VTs, surge capacitor, lightning arrester, V.T. L.V. side fuses etc.
- d) Each VT and SP cubicle shall have seal off busing at the terminations to cubicle.
- e) Lightning arrester shall be Gapless type station class, hermetically sealed, connected between line and ground, specifically suitable for generator protection. A discharge counter shall be provided for each lightning arrester. The discharge counter register shall be visible without having to open the compartment door.
- f) Mineral oil filled/Askarel (PCBS) filled surge capacitor shall not be acceptable.

TECHNICAL REQUIREMENTS

- g) The voltage transformer shall be epoxy cast-resin type, suitable for nominal voltage operation, connected from line to ground. The voltage transformer along with secondary fuses shall be mounted on draw out type carriage. Suitable guide slots and stops shall be provided to ensure easy withdrawal and positioning. The fixed and draw out contacts of voltage transformer primary shall be tinned or silver plated.
- h) In the disconnected position, the voltage transformer primary and secondary circuits shall be automatically disconnected. The draw out frame shall be grounded at all times. A reliable automatically operated shutter mechanism shall be provided for isolating and shrouding the bus bar live parts when the VT is in drawn out position.
- i) The secondary leads from the voltage transformer shall be extended to two separate fuses for dual accuracy PT and terminal cabinet flush mounted in the compartment.
- j) From phase cabinets the VT secondary leads shall be brought to marshalling box having sufficient number of terminals with 20% spare, to accommodate all VT leads. Facility of making star points and undrilled gland plate for cable connections shall be provided in the marshalling box.
- k) VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks, provided in the instrument transformer marshalling boxes. The facility for connecting to earthing grid shall be provided by the contractor through suitable connectors in the marshalling box with isolating links for testing of instrument transformers.

9.00.00 **Neutral Grounding Cubicle**

- a) The cubicles shall have hinged access doors capable of being pad locked.
- b) The transformer cubicle shall be made of angle frame steel construction with formed sheet sides. The resistor cubicle shall be made of angle frame steel construction with hot dip galvanised screen sides. Alternatively it can be painted with heat resistant paint suitable for 250 deg.C. The neutral grounding equipment shall be completely assembled, wired and connected to the neutral bus tap through seal-off bushing.
- c) The neutral grounding transformer shall be cast epoxy resin type natural air cooled single phase connected between generator neutral and ground.
- d) The loading resistor shall be formed of non-aging, corrosion resistant punched stainless steel grid element provided with necessary insulation and designed for indoor service for a temperature rise not exceeding 300 deg.C.
- e) All alarm, protection and indication leads shall be wired up to terminal blocks that shall be mounted in a IP:52 enclosure suitable for flush mounting and having a fully hinged cover with lock.

10.00.0 **Cubicle Construction (V.T. & S.P., N.G. Cubicle Etc.)**

- a) All cubicles shall be fabricated from cold rolled sheet steel for minimum 2mm thick suitably reinforced to ensure structural rigidity. The degree of protection for all indoor cubicle shall be IP:52 except for neutral grounding resistor enclosure which shall be minimum IP:23.
- b) **Space heater, Illumination and Grounding**
Each cubicle shall be equipped with space heater with thermostat, internal illumination lamp, 240 V AC, 5A receptacle. Ground bus suitable for receiving

TECHNICAL REQUIREMENTS

two (2) numbers of 50x6mm galvanised steel flats shall be provided on each cubicle.

11.00.00 **Wiring**

- a) All wiring shall be done with insulated stranded copper conductor of not less than 2.5 sq.mm cross-section with suitable lugs on both sides.
- b) The wiring inside the bus duct enclosure shall be suitable for operating in the ambient temperature existing inside the bus duct.
- c) Not more than two wires shall be connected to a terminal. Spare terminals equal in number to 20% of active terminals shall be furnished and these shall be uniformly distributed throughout the cubicle CT terminal blocks shall be of stud type and suitable for round type lugs with a facility for isolation, shorting and grounding. It shall be Elmex type CATD or equivalent.

12.00.00 **Name Plate**

- a) Name plates shall be furnished for each equipment, disconnect link, voltage transformer compartment, lightning arrester compartment and fuse block, current transformer TB, etc.
- b) Material for name plate shall be plastic / lamicaid 3mm thick using white letters on black background.

13.00.00 **Finish**

- a) Except for supporting steel structures which shall be galvanised, all equipment including bus duct enclosure shall be finished with an under coats of high quality primer followed by two coats of synthetic enamel paint which shall have a thickness not less than 50 microns.
- b) The interior surface finish of bus duct enclosure shall be as per manufacturer's standard. The shade of exterior surface shall be shade RAL 5012 for busduct and equipment. The shade of interior surface of cubicles shall be glossy white. The identification tag shall be signal red shade ISC 537 or RAL 3001
- c) Pre-treatment consisting of degreasing, de-rusting etc. shall be done on all fabricated parts before painting of cubicles, cabinets, marshalling boxes and galvanization of steel structures.

14.00.00 **TYPE TESTS**

- (a.) All equipment to be supplied shall be of type tested design. The Contractor shall submit for Owner's approval the reports of all the type tests (as listed out in relevant clauses) carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
- (b) In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost either at third party lab or in presence of client/owners' representative and submit the reports for approval. The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days'

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notice shall be given by the contractor.

- (b.) All routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- (d.) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

14.02.00 **A. LIST OF TYPE TEST**

Type test report for the following test shall be furnished:

- a) Heat run test on an assembly of representative sections and fittings with all types of flexibles, CTs etc.
- b) Short circuit withstand test (set up same as for heat run) for one (1) sec. duration and current as per system requirement on assembly of representative section with CT's bellows, flexibles.
- c) Impulse withstand test on an assembly of representative section containing Flexibles, Bellows, Seal of bushing, CT's mounted in position (wherever applicable).
- d) One minute high voltage power frequency withstand test (set up as for short circuit test).
- e) Water tightness test as per IS:8084 (set up shall include inspection cover, flanged joint and bellow).
- f) Air leakage test as per IS:8084 (set up shall include inspection cover, flanged joint and bellow)

Panels, cubicles and marshalling boxes shall be type tested for the degree of protection provided by enclosure as specified below:

- (1.) For 5X-it shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.
- (2.) For 4X-It shall not be possible to insert a one mm diameter steel wire into enclosure from any direction without force.
- (3.) For 2X-It shall not be possible to insert a twelve (12) mm dia steel wire into the enclosure from any direction without any force.
- (4.) Test for second digit shall be in line with IS:13947 pt.1

8.03.00 **Routine Test**

Routine test shall be conducted at manufacturer's works on each busduct and all other components as per relevant Indian Standards & Quality Assurance Sub-section.

8.03.02 **MV Busduct (SPBD)**

Radiography Test (RT) shall be conducted as follows:

- a) 10% on flexible conductor

9.00.00 **INSTALLATION CHECKS**

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9.00.01 **MV Busduct (SPBD)**

- a) 10% radiography and 100% DP test on all site welded joints of busbar and enclosure.
- b) Milli volt drop test
- c) Insulation resistance measurement of equipment and all wiring

10.00.0 COMMISSIONING CHECKS

10.00.01 **MV Busduct (SPBD)**

- a) Power frequency voltage withstand test
- b) Air leakage test
- c) Water tightness test on outdoor portion of busduct

PART-B

VOLUME – II

CHAPTER – II-E5

HT & LT POWER CABLES & CONTROL CABLES

TECHNICAL REQUIREMENTS

MOTORS

1.00.00 GENERAL REQUIREMENTS

- 1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.
- 1.02.00 All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.
- 1.03.00 Contractor shall provide fully compatible electrical system, equipment, accessories and services.
- 1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.
- 1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.
- 1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.
- 1.07.00 Degree of Protection

Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-

- | | | |
|----------------------------|---|-------|
| i) Indoor motors | - | IP 54 |
| ii) Outdoor motors | - | IP 55 |
| iii) Cable box-indoor area | - | IP 54 |
| iv) Cable box-Outdoor area | - | IP 55 |

2.00.00 CODES AND STANDARDS

- | | | |
|---------------------------------|---|-------------------------|
| 1) Three phase induction motors | : | IS/IEC:60034 |
| 2) Single phase AC motors | : | IS/IEC:60034 |
| 3) Crane duty motors | : | IS:3177, IS/IEC:60034 |
| 4) DC motors/generators | : | IS/IEC:60034 |
| 5) Energy Efficient motors | : | IS 12615, IEC: 60034-30 |

3.00.00 TYPE

3.01.00 AC Motors:

- a) Squirrel cage induction motor suitable for direct-on-line starting.
- b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30.
- c) Crane duty motors shall be squirrel cage Induction motor as per the requirement.
- d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

TECHNICAL REQUIREMENTS

3.02.00 DC Motors Shunt wound

4.00.00 RATING

- (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.
- (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

5.00.00 TEMPERATURE RISE

Air cooled motors

70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.

Water cooled

80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.

6.00.00 OPERATIONAL REQUIREMENTS

6.01.00 Starting Time

6.01.01 For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.

6.01.02 For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.

6.01.03 For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.

6.01.04 Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.

6.02.00 Torque Requirements

6.02.01 Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.

6.02.02 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

6.03.00 Starting voltage requirement

- (a) Up to 85% of rated voltage for ratings below 110 KW
- (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW
- (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW
- (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW
- (e) Up to 75 % of rated voltage for ratings above 4000KW

7.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

TECHNICAL REQUIREMENTS

- 7.01.00 Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.
- 7.02.00 All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACCA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below
- (a) Fuel oil area : Group – IIB
- (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)
- 7.03.00 Winding and Insulation
- (a) Type : Non-hygroscopic, oil resistant, flame resistant
- (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature.
- (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation.
The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & intertern insulation surge withstand level shall be as per IEC-60034 part-15.

However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.
- (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
- 7.04.00 Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.
- 7.05.00 Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
- 7.06.00 Noise level for all the motors shall be limited to 85dB (A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
- 7.07.00 In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer and 2 numbers duplex platinum resistance type temperature detectors.

TECHNICAL REQUIREMENTS

- 7.08.00 Motor body shall have two earthing points on opposite sides.
- 7.09.00 11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.
- 7.10.00 3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.
- 7.11.00 The spacing between gland plate & center of terminal stud shall be as per Table-I.
- 7.12.00 All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
- 7.13.00 The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
- 7.14.00 For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
- 7.15.00 The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.
- 8.00.00 The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.
- | | | | |
|-----|----------------------------|---|----------|
| (a) | From 50KW & upto 110KW | : | 11.0 |
| (b) | From 110 KW & upto 200 KW | : | 9.0 |
| (c) | Above 200 KW & upto 1000KW | : | 10.0 |
| (d) | From 1001KW & upto 4000KW | : | 9.0 |
| (e) | Above 4000KW | : | 6 to 6.5 |
- 9.00.00 Not applicable

10.00.00 TYPE TESTS

(a.) All equipment to be supplied shall be of type tested design. The Contractor shall submit for Owner's approval the reports of all the type tests (as listed out in relevant clauses) carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

(b.) In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract at no additional cost either at third party lab or in presence of client/owners' representative and submit the reports for approval. The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days' notice shall be given by the contractor.

(c.) All routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

TECHNICAL REQUIREMENTS

(d.) The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

10.01.00

LIST OF TYPE TESTS FOR HT MOTOR

Type test report for the following test shall be furnished:

- (a) No load saturation and loss curves upto approximately 115% of rated voltage
- (b) Measurement of noise at no load.
- (c) Momentary excess torque test (subject to test bed constraint).
- (d) Full load test (subject to test bed constraint)
- (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.
- (f) Degree of protection test for the enclosure followed by IR, HV and no load run test.
- (g) Terminal box-fault level withstand test for each type of terminal box of HT motors only.
- (h) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15
- (i) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15

10.02.00

LIST OF TYPE TESTS FOR LT MOTOR

Type test report for the following test shall be furnished:

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip.
5. Temperature rise test.
6. Momentary excess torque test.
7. High voltage test.
8. Test for vibration severity of motor.
9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)
10. Test for degree of protection and
11. Over speed test.

TECHNICAL REQUIREMENTS

12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

TECHNICAL REQUIREMENTS

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm As per manufacturer's practice.
UP to 3 KW	
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

PART-B

VOLUME – II

CHAPTER – II-E5

HT & LT POWER CABLES & CONTROL CABLES

TECHNICAL REQUIREMENTS

HT & LT POWER CABLES & CONTROL CABLES

1.00.00 CODES AND STANDARDS

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS: codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes :

IS:7098 (Part -II)	Specification for Cross linked polyethylene insulated PVC sheathed cables. Part-II: For working voltages from 3.3 KV upto and including 33 KV.
IS : 3975	Low Carbon Galvanized steel wires, formed wires and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IEC- 332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

2.00.00 TECHNICAL REQUIREMENTS

- 1.01.00 All cables (HT Power, LT power and control cables) shall be armoured type only irrespective of anything contrary mentioned elsewhere in the specification. All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- 1.02.00 Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be multi stranded.
- 1.03.00 XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.
- 1.04.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.

TECHNICAL REQUIREMENTS

- 1.05.00 The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm-sq.mm/mtr at 20 deg.C. The types and sizes of aluminium armouring shall be same as mentioned for galvanised steel at 2.06.00 above.
- 1.06.00 Distinct extruded PVC inner sheath of black colour as per IS:5831 shall be provided for the cables as follows:
- a). For all multicore cables.
- b). For single core armoured cables, where armouring is not being used as metallic screen.
- 1.07.00 Outer sheath shall be of PVC black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.
- (a.) Oxygen index of min. 29 (Test method as per IS 10810 Part-58)
- (b.) Acid gas emission of max. 20% as per IEC-754 (Part-I)
- (c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM-D-2843.
- 1.08.00 Allowable tolerances on the overall diameter of the cables shall be +\ -2 mm maximum over the declared value in the technical data sheets.
- 1.09.00 Cable lengths shall be considered in such a way that straight through cable joints is avoided.
- 1.10.00 All Cables shall be armoured type only.
- 1.11.00 All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- 1.12.00 All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and **sizes shall be of 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm** However for cable sizes upto 120 sq.mm. both XLPE insulated & PVC insulated LT power cables are acceptable
- 3.00.00 **Cable selection & sizing**
- 3.00.01 Cables shall be sized based on the following considerations:
- a) Rated current of the equipment
- b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage
- c) Short circuit withstand capability
- 3.00.02 **Derating Factors**
- Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes:
- a) Variation in ambient temperature for cables laid in air
- b) Grouping of cables
- a) Variation in ground temperature and soil resistivity for buried cables.

The bidder shall furnish detailed cable selection/sizing criteria for Employer's approval

4.00.00 CONSTRUCTIONAL FEATURES

4.00.01 19/33 KV Grade Power Cables:

Cables shall conform to IS 7098 Part-II. These cables shall be multi-stranded, compacted circular aluminium conductor, XLPE-insulated, metallic screened PVC outer sheathed. The conductor screen and insulation screen shall both be of extruded semiconducting compound and shall be applied along with the XLPE insulation in a

TECHNICAL REQUIREMENTS

single operation of triple extrusion process so as to obtain continuously smooth interfaces. Method of curing for 19/33 KV Cables shall be “dry curing / gas curing “. The metallic screen for each core shall be capable of carrying the system earth fault current and shall consist of copper wires or tape with minimum overlap of 20%. However, for single core armoured cables, the armouring shall constitute the metallic part of the screening.

4.00.02 11/11KV Grade Power Cables:

Cables shall conform to IS-7098 Part-II. These cables shall be multi-stranded, compacted circular aluminium conductor, XLPE-insulated, metallic screened, PVC outer sheathed. The conductor screen and insulation screen shall both be of extruded semiconducting compound and shall be applied along with the XLPE insulation in a single operation of triple extrusion process so as to obtain continuously smooth interfaces. Method of curing shall be “dry curing / gas curing / steam curing “. The metallic screen for each core shall be capable of carrying the system earth fault current and shall consist of copper wires or tape with minimum overlap of 20%. However, for single core armoured cables, the armouring shall constitute the metallic part of the screening.

5.00.00

TYPE, ROUTINE AND ACCEPTANCE TESTS

5.01.00

The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power and control cables. Size shall be decided by the employer during detailed engineering

S. No	Type Test Conductor	Remarks
1.	Resistance test For Armour Wires / Formed Wires	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Elongation test	
5.	Torsion test	For round wires only
6.	Wrapping test	
7.	Resistance test	
8(a)	Mass & uniformity of Zinc Coating tests	For GS wires/formed wires only.
8(b)	Adhesion test For XLPE insulation & PVC Sheath	For GS wires/formed wires only
9.	Test for thickness	
10.	Tensile strength and elongation test before ageing and after ageing	
11.	Ageing in air oven	

TECHNICAL REQUIREMENTS

S. No	Type Test	Remarks
12.	Loss of mass test	For PVC outer sheath only.
13.	Hot deformation test	For PVC outer sheath only.
14.	Heat shock test	For PVC outer sheath only
15.	Shrinkage test	
16.	Thermal stability test	For PVC outer sheath only
17.	Hot set test	For XLPE insulation only
18.	Water absorption test	For XLPE insulation only
19.	Oxygen index test	For PVC outer sheath only
20.	Smoke density test	For PVC outer sheath only
21.	Acid gas generation test	For PVC outer sheath only
22	Flammability test as per IEC-332 Part-3 (Category -B)	For completed cable only

5.02.00 The following type tests reports shall be submitted for each type (voltage grade) & size of the cable:

S. No.	Type Test For all cables
1.	Insulation resistance test (Volume Resistivity method)
2.	High voltage test
For cables of 19/33kV, 11/11KV Grade only.	
3.	Partial discharge test
4.	Bending test
5.	Dielectric power factor test
	a) As a function of voltage
	b) As a function of temperature
6.	Heating cycle test
7.	Impulse withstand test

Indicative list of tests/ checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of H.T. Cables enclosed.

PART-B
VOLUME – II
CHAPTER – II-E6
STATION LIGHTING

TECHNICAL REQUIREMENTS

STATION LIGHTING

1.00.00	GENERAL	
1.01.00	This specification covers the general description of design, manufacture and construction features, testing, supply, installation and commissioning of the Station Lighting system equipment.	
1.02.00	Lighting Panels, Switch-boxes, Receptacles and Junction Boxes	
	IS:2147	Degree of protection provided by enclosures for low-voltage switchgear and control gear.
	IS:1293	Plugs & socket outlets of rated voltage upto and Including 250volts & rated current upto and including 16 Amps.
	IS:2551	Danger notice plates.
	IS:13947	Low voltage switchgear and controlgear
	IS:3854	Switches for domestic and similar purposes.
	IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC.
	IS:13703	Low voltage fuses for voltages not exceeding 1000V AC or 1500 V DC.
1.03.00	Lighting Wires/Cables	
	IS:694	PVC insulated cables for working voltages upto and including 1100 V
	IS:3961	Recommended current ratings for cables.(PVC Insulated and PVC sheathed heavy duty cables and light duty cables).
	IS:8130	Conductors for insulated electric cables and flexible cords.
	IS:10810	Methods of tests for cables.
1.04.00	LED Luminaries	
	16101:2012	General Lighting. LEDs and LED modules Terms and definitions
	16102(Part 1):2012	Self Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.
	16102(Part 2):2012	Self Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.
	16103(Part I):2012	LED modules for General lighting Safety Requirements.
	15885(Part 2/Sec. 13) :2012	Lamp control gear Part 2 particular Requirements Section 13 d.c. or a.c. Supplied Electronic control gear for LED modules d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.
	16104:2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.
	16105:2012	Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products
	16107:2012	Luminaires Performance
	16108:2012	Photobiological safety of Lamps and Lamp Systems
	IS 513	Cold rolled low carbon steel sheets and strips
	IS 12063	Classification of degree of protection provided by enclosures.
	IS 14700	Electro magnetic compatibility (EMC) – Limits

TECHNICAL REQUIREMENTS

	(Part 3/Sec. 2)	for Harmonic current emission – THD < 15% (equipment, input current < 16 Amps. per phase.
IS 9000 (Part 6)	Environment testing: Test Z – AD:	
IS 15885	composite temperature/humidity cyclic test.	
	Lamp control gear: particular requirements for (Part 2/Sec. 13)	DC or AC supplied electronic control gear IS 16004 – 1 and 2) for LED modules.
IS 4905	Method for random sampling	

2.00.00 LIGHTING SYSTEM DESCRIPTION

2.01.00 The illumination of various indoor and outdoor areas in the main plant & offsite area shall be provided as described here. The lighting system of various areas shall comprise of the following systems as identified in Annexure-B:

- (a) Normal AC Lighting System
- (b) Emergency AC Lighting System
- (c) DC Lighting System

2.02.01 Normal AC Lighting System

Normal AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels (LPs) which in turn will be fed from the lighting distribution boards (LDBs)/Switch board MCC.

2.02.02 Emergency AC Lighting System

This system shall be provided for certain important areas in the main plant. The lighting fixtures connected to this system shall be normally "ON" along with the normal AC system. These will be fed from emergency lighting panels (ELPs) which in turn will be fed 3-phase, 4-wire supply from the emergency lighting distribution boards (ELDB'S). These lights will go off for a few seconds in case of AC supply failure at Emergency Switchgear, but shall be automatically restored when Emergency Switchgear is energised by Diesel generator set.

2.03.00 DC Lighting System

2.03.01 At strategic locations in the main plant, a few lighting fixtures fed from 220V, DC supply, shall be provided to enable safe movement of operating personnel and access to important control points during an emergency, when both the normal AC and Emergency Lighting system fail. These lighting fixtures will be fed from 220V DC LDBs which in turn will be fed from DC lighting panels.

2.03.02 The supply to the DC lighting panels shall be automatically switched ON in case of loss of AC supply at station service switchgear as well as Emergency switch-gear. The DC supply will be automatically switched OFF after about 3 minutes following the restoration of supply to normal AC or emergency AC lighting system.

2.03.03 Emergency DC lighting is to be provided, through self-contained DC emergency fixtures with four hours back-up duration, at strategic locations, in auxiliary/offsite buildings wherever DC supply system is not available. The fixtures shall be switched 'ON' automatically in case of failure of AC supply.

3.00.00 DESIGN PHILOSOPHY

1. A comprehensive illumination system shall be provided in the entire project areas under bidder's scope.
2. All outdoor lighting system shall be automatically controlled by synchronous timer. Provision to bypass the timer shall be provided in the panel.
5. Different Lighting Systems envisaged for various plant areas are indicated in Annexure-B: While finalizing the detailed layout of lighting fixtures, the position/location and layout of equipments should be taken into account to have adequate illumination at desired locations.
6. **LED Luminaires:**

LED Luminaires shall be used for the lighting of all the indoor & outdoor areas in bidder's scope. However for DC lighting, hazardous areas & aviation lighting etc. conventional type luminaires shall be used. However, aviation light in Lighting Mast shall be of LED type. In false ceiling area LED luminaires shall

TECHNICAL REQUIREMENTS

be recessed mounting type & in non-false ceiling area the LED luminaires shall be surface mounting type.

The individual lamp wattage for LED shall be upto 3 watt. Fractional wattage LEDs are also acceptable. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall be not less than 80 Lm/W. Suitable heat sink shall be designed & provided in the luminaire. The LED used in the luminaires shall have colour rendering index (CRI) of Min 80. Colour designation of LED shall be "cool day light" (min 5700K) type for indoor areas. However for outdoor areas, the colour temperature of LED shall be min. 4000K, including rough & dust prone areas. LED shall conform to the LM 80 requirements.

The max. junction temperature of LED shall be 85 deg C. Further the lumen maintenance at this temperature shall be min 90%. The THD of LED Luminaires shall be less than 10%. Further the EMC shall be as per IS 14700. The power factor of the luminaire shall not be less than 0.9. The marking on luminaire & safety requirements of luminaire shall be as per IS standards. Suitable heat sink with proper thermal management shall be designed & provided in the luminaire.

The connecting wires used inside the system, shall be low smoke halogen free, fire retardant type and fuse protection shall be provided in input side specifically for LED luminaires.

The entire housing shall be dust and water proof protection as per IS 12063.

7. **Driver Circuit**

LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED chip manufacturer. LED Drivers shall have following control & protections:-

- Suitable precision current control of LED.
- Open Circuit Protection
- Short Circuit Protection
- Over Temperature Protection
- Overload Protection
- Surge Protection

8

9. All lighting fixtures and control gears shall be powder coated. All outdoor fixtures shall be weather proof and of min. IP55 degree of protection.

10. (a) Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have min. IP55 degree of protection.

(b) Lighting panels shall be constructed out of 2 mm thick CRCA sheet steel. The door shall be hinged and the panel shall be gasketed to achieve specified degree of protection

(d) Terminal blocks shall be 1100 V grade, clip-on stud type, made up of polyimide 6.6 or better suitable for terminating multicore 35 or 70 Sq. mm. stranded aluminium conductor incoming cable and 10 Sq. mm. stranded aluminium conductor for each outgoing circuits voltage. All terminals shall be shrouded, numbered and provided with identification strip for the feeders.

(e) MCB's shall be current limiting type with magnetic and thermal release suitable for manual closing and automatic tripping under fault condition. MCB's shall have short circuit interrupting capacity of 9 KA rms.

(f) Contactors of AC lighting panels shall be 3 no's, 32 A, 3 pole continuous duty MCB, load make-break type suitable for 415 V, 3 phase 4 wire system. HRC fuses with suitable mounting base of 125A shall be provided in the incomer of Contactors in the LP.

(g) DC switches shall be rotary type, 2 pole, continuous duty, load break type, quick make quick break, suitable for 220 V DC, 2 wire system. Switch knob shall be provided with ON/OFF indication.

(h) Programmable Digital Timer shall be Electronic Astronomical Almanac Time switch with battery back up of min. TEN years, 4 Digit LED display, 24 hours range,

TECHNICAL REQUIREMENTS

manual override facility, 10 Amp 3 relay output, with NO/NC Contacts suitable for operation on 240V single phase AC supply.

(i) Each lighting panel (LP-3) shall be fed from a 415V/42V, 3 phase-4 wire, 3 KVA transformer. The transformer shall be located inside the lighting panel itself. Transformers shall be dry type, natural air cooled with class F insulation or better. Impedance of transformer shall be 5%. Transformers shall be tested as per IS:11171. Off-circuit tap changer with +/- 5% in steps of +/- 1.25% tapping shall be provided. One minute power frequency withstands voltage for lighting transformer shall be 2.5 KV.

11. Wires of different phase shall normally run in separate conduit.
12. Power supply shall be fed from 415 / 240 V normal AC supply, emergency AC supply and 220V DC supply through suitable number of conveniently located lighting distribution boards (LDB) and lighting panels (LP). AC lighting supply shall be isolated from main supply by isolation transformers of max. rating of 100KVA and fault level restricted to 3 KA at Lighting Panels.
13. Atleast one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc. Further 20A, 240V AC industrial receptacle with switch shall be provided strategically in all industrial areas.
Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for entire plant for welding purposes, particularly near all major equipment and at an average distance of 50m. Atleast one 63A, 3ph, 415V AC receptacle shall be provided in each floor of off-site buildings/ structures.

Receptacles shall be of following types :

Type	Switch rating	Socket & plug rating	Type & make of plug & Socket	Terminal Block size
RA	20 A, SP240V AC(Industrial)	20A, 3 pin240 V AC	NTPC appd. make	1-4 way, suitable for loop-in loop- out of 10 sq.mm. Al. Conductor
RB	16A, S.P240V AC	6A+16A6 decorative Piano-key Type Switch	NTPC appd.make	1-4 way, suitable for loop-in loop- out of upto 10 sq.mm. Al. Conductor
RC	20 A, SP24 V AC(Industrial)	20A, 3 pin24 V AC	NTPC appd. make	1-4 way, suitable for loop-in loop- out of 2 core -16 sq.mm. Al. Cable.

17. Aviation warning lights shall be provided as per the recommendations of ICAO and Director general of civil aviation, India. The arrangement of light should be marked such that the object is indicated from every angle in azimuth. The aviation warning lighting system shall also conform to the latest Indian standard IS 4998.

18. Contractor shall demonstrate the average lux level achieved for different areas as per specification requirements, after completion of the lighting work, at site to the satisfaction of engineer-in-charge.

3.01.00

Ballasts

3.01.01

All fluorescent fixtures except for Class-I, Div-II fittings/ increased safety fittings (Div-II/Hazardous Area) shall be provided with electronic ballasts.

TECHNICAL REQUIREMENTS

3.02.00 All luminaires and their accessories and components shall be of type readily replaceable by available Indian makes.

3.03.00 **Fans & Regulator**

3.03.01 Ceiling Fans, to be provided in non air-conditioned office/control room area. Further tentatively one (1) no. ceiling fan shall be provided for 10 sq.m area, at suitable mounting height.

3.04.00 **Lighting Wires**

3.05.01 Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. Minimum size of wire shall not be less than 1.5.sq.mm. for copper and 4 sq.mm. for aluminium.

3.06.00 **Lighting Poles**

3.06.01 The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. The Poles shall be mounted above ground using base plate and minimum height of pole shall be 8 mtrs The poles shall be hot-dip galvanized as per IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.

3.07.00 **Lighting Masts**

3.07.01 Suitable number of lighting masts shall be provided for entire plant. Lighting Mast shall be of continuously tapered polygonal cross section hot dip galvanised. The Mast shall be of 30 M or suitable height with lantern carriage to enable raising/lowering for ease of maintenance, including the Head Frame, Double Drum Winch, continuous stainless steel wire rope, in built power tool, luminaires, suitable aviation warning light, lightning alongwith necessary power cables within the mast. The mast shall be delivered in not more than three sections & shall be joined together by slip stressed fit method at site. No site welding or bolted joints shall be done on the mast.

The Mast together with the fixtures shall be capable of withstanding the appropriate wind loads as per IS: 875. The Mast shall be fabricated from special steel plates conforming to BS-EN10-025 and folded to form a polygonal section.

4.00.00 TESTS

4.01.00 For LED Fixture

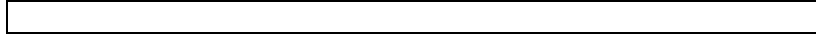
4.01.01 Type test reports of the following items as per technical specification requirements/ standards shall be submitted for approval.

SL NO.	DESCRIPTION
i.	Lighting fixtures of each type
ii.	Lighting panel of each type (Degree of Protection)
iii.	Junction Box of each type.

Type test reports for LED as per standards for following shall be submitted for approval.

1. Visual and Dimension check
2. Proof of procurement of LEDs
3. Safety tests
a) Marking
b) Construction
c) Provision for Earthing
d) External and Internal wiring
e) Protection against electrical shock
f) Endurance and Thermal
g) Insulation resistance & electrical strength
h) Resistance to heat fire & tracking
i) Resistance to Humidity
4. Fire Retardant test
5. Performance tests (electrical, Photometric color and Life)
6. Burn-in Test
7. Power Cycling
8. Temperature rise test
9. Emission Tests
a) Radiated & conducted emission
b) Harmonics & flickers
10. Immunity tests

TECHNICAL REQUIREMENTS



In addition, following test reports to be submitted for LED chip/LED luminaire:

- a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer.
- b) LM 80/IS: 16105 report.
- c) LM 79/IS: 16106 report.

4.02.00

Acceptance Test and Routine Test

4.03.00

All lighting fixtures, lamps and other items shall be subjected to acceptance and routine test, as per relevant specified standards.

PART-B
VOLUME – II
CHAPTER – II-E7
CABLING, EARTHING
AND
LIGHTNING PROTECTION

TECHNICAL REQUIREMENTS

CABLING, EARTHING AND LIGHTNING PROTECTION

1.00.00 Cabling

- 1.01.00 Cable trays shall be ladder type for power & control cables & perforated type for instrumentation cables complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Minimum thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be minimum 3 mm. Cable tray & cable tray supporting arrangement shall be hot dip galvanized. Support system shall be able to withstand
- Weight of the cable trays
 - weight of the cables (75 Kg/Metre run of each cable tray)
 - Concentrated load of 75 Kg between every support span.
 - Factor of safety of minimum 1.5 shall be considered.
- 1.02.00 Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.
- 1.03.00 Cable trays shall be supported at an interval of 2000 mm. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm.
- 1.04.00 Power and control cables shall be laid on separate tiers. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every 2mtr. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with self locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.
- 1.05.00 **TERMINATION AND STRAIGHT THROUGH JOINTS**
Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables.
- 1.06.00 Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12

TECHNICAL REQUIREMENTS

sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design

1.07.00

(A)

Welding Receptacles

Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity.

(B)

TPN 63A welding sockets with switch having degree of protection of IP-55 shall be provided in the following areas.

- 1) 1 no. in each Switchgear/MCC rooms and Pump house.
- 2) Maximum three (3) nos. of receptacles can be connected to one circuit. These receptacles shall be energised from MCC.

2.00.00

Earthing System

2.01.00

Earthing system shall be in strict accordance with IS: 3043 and Indian Electricity Rules/Acts. Scope of the Bidder shall also include supply and laying of 40mm dia. MS Rods as earthing mat, placed at a distance of 1.0M away and at depths between 0.60M and 1.00M, all around the periphery of buildings, structures, and outdoor equipments, as per the approved drawings. Risers of 40mm dia. MS Rods and connecting to the above Earthing mat shall also be supplied and laid in position by the Bidder, as per the approved drawings. Risers shall be laid upto a height of 300mm above the local Ground level, at each of the columns of the buildings on outside of the buildings. The Bidder's scope shall also include supplying and laying of necessary number of 3.0M deep vertical 40mm dia. MS Rods Earthing electrodes and connecting them to the Earthing mat, as per the approved drawings and the supplying and laying of 40mm dia. MS Rods,

The material of the earthing conductors shall be as follows :

Conductors above ground level and in built up trenches. - Galvanized steel

Conductors buried in earth - Mild steel

Earth electrodes - Mild steel rod

2.02.0

The sizes of earthing conductors for various electrical equipments shall be as below:

Equipment	Earth conductor above ground level & in built-up trenches
-----------	---

- | | | |
|----|--|-------------------|
| a) | Main earth grid | |
| | i) Earth conductor buried in earth around buildings. | 40 mm dia. MS ROD |
| | ii) Earth conductor above ground level & in built up trenches. 11KV/6.6KV/3.3KV SWGR/EQUIP and 415V SWGR | 65x8 mm GS flat |

TECHNICAL REQUIREMENTS

- | | | |
|----|--|-------------------|
| b) | 415 V MCC/ Distribution boards / Transformers | 50x6mm GS flat |
| | LT Motors above 125 KW | 50 x 6mm GS flat |
| | 25 KW to 125 KW | 25 x 6mm GS flat |
| | 1KW to 25 KW | 25 x 3mm GS flat |
| c) | Fractional House power motor | 8 SWG GS wire |
| d) | Control panel & control desk | 25 x 3 mm GS flat |
| e) | Push button station / Junction Box | 8 SWG GI wire |
| f) | Columns, structures, cable trays | 50x6mm GS flat |
| | Crane, rails, rail tracks & other non-current carrying metal parts | 25x6mm GS flat |

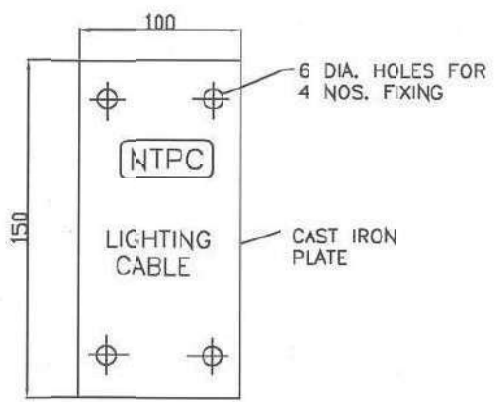
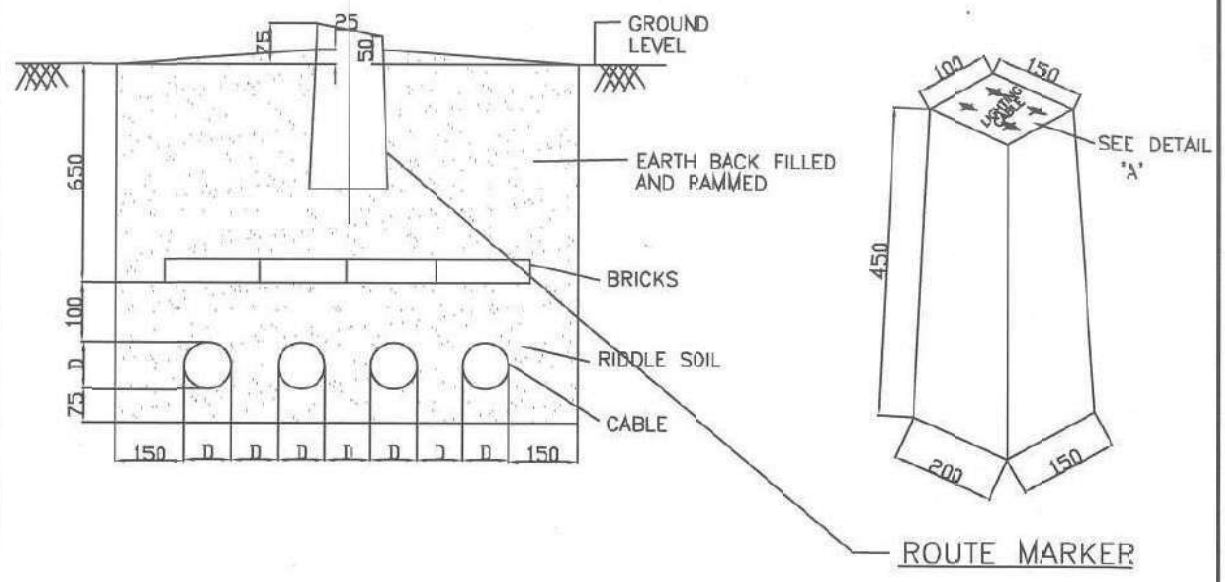
- 2.03.00 Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed at switchgear end only unless otherwise approved. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Railway tracks within the plant area shall be bonded across fish plates and connected to earthing grid at several locations. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable.
- 2.04.00 Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground
- 2.05.00 Neutral points of HT transformer shall be earthed through NG resistors. The Contractor shall connect the NGR earthing point to earth electrodes by suitable earth conductors.
- 2.06.00 Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.
- 2.07.00 Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.
- 2.08.00 Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm.
- 2.09.00 Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover.

3.00.00 LIGHTNING PROTECTION SYSTEM

TECHNICAL REQUIREMENTS

- 3.01.00 Lightning protection system shall be in strict accordance with IEC:62305
- 3.02.00 Lightning conductor shall be of 25x6mm GS strip when used above ground level and shall be connected through test link with earth electrode/earthing system
- 3.03.00 Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings
- 3.04.00 Down Conductors
1. Down conductors shall be as short and straight as practicable and shall follow a direct path to earth electrode.
 2. Each down conductor shall be provided with a test link at 1000 mm above ground level for testing but it shall be in accessible to interference. No connections other than the one direct to an earth electrode shall be made below a test point.
 3. All joints in the down conductors shall be welded type.
 4. Down conductors shall be cleated on outer side of building wall, at 750 mm interval or welded to outside building columns at 1000 mm interval.
 5. Lightning conductor on roof shall not be directly cleated on surface of roof. Supporting blocks of PCC/insulating compound shall be used for conductor fixing at an interval of 1500 mm.
 6. All metallic structures within a vicinity of two meters of the conductors shall be bonded to conductors of lightning protection system.
 7. Lightning conductors shall not pass through or run inside GI Conduits.
 8. Testing link shall be made of galvanized steel of size 25x 6mm.


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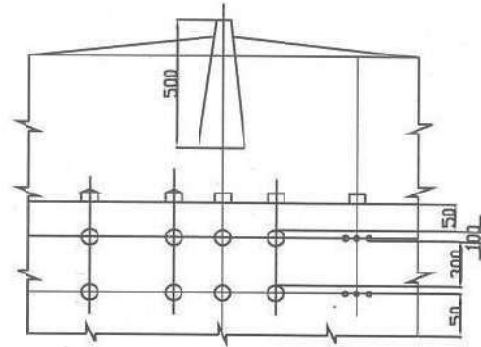
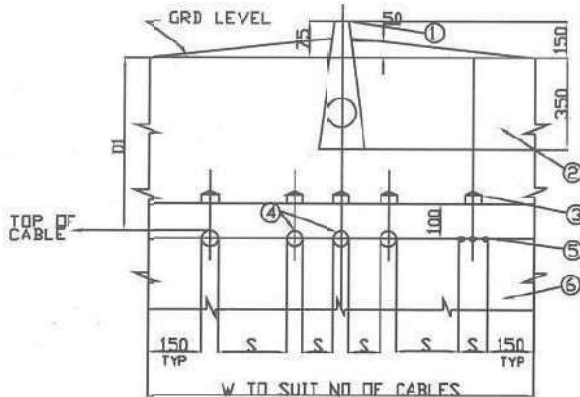
DETAIL - 'A'

NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. ROUTE MARKERS SHALL BE CONSTRUCTED OF CONCRETE WITH CAST IRON PLATE, WITH THE ROUTE INFORMATION ENGRAVED ON IT, BOLTED ON TOP OF THE CONCRETE BLOCK AS SHOWN.
3. CAST IRON PLATE SHALL BE OF Min. 6.0mm THICKNESS.

RC	FOR TENDER PURPOSE	13	13	RKP	-	NS	-	-	-	AS	05/07/20
RB	FOR TENDER PURPOSE	RKG	RKG	VKM	-	SS	-	-	-	AS	06/11/2000
RA	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	-	17/01/2000
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
		NTPC LTD. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION									
PROJECT		STANDARD									
TITLE		BURIED CABLE TRENCH DETAILS FOR LIGHTING									
SIZE	SCALE	DRG. NO.							REV. NO.		
A4	NTS	0000-211-POE-A-049							RC		

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DIRECTLY BURIED CABLES
IN SINGLE LAYER

DIRECTLY BURIED CABLES
IN TWO LAYER

LEGEND

- ① — CABLE ROUTE MARKER
- ② — EARTH BACK FILLED & RAMMED
- ③ — PROTECTIVE COVERS
 - a) BRICKS FOR LOW VOLTAGE CABLES
 - b) RCC FOR HIGH VOLTAGE CABLES WITH HOLE AT EACH END TO TIE EACH OTHER WITH G.S. WIRE
- ④ — ARMoured POWER CABLE
- ⑤ — ARMoured CONTROL CABLE
- ⑥ — FINE SAND/RIDDED SOIL COMPACTED

DIMENSION MIN	1100V GRADE CABLES	FOR 3.3 KV TO 11KV	ABOVE 11KV & UPTO 33KV
D1	750	900	1050
S	= d BETWEEN CABLES OF SAME CLASS = 300MM BETWEEN CABLES OF DEFT CLASS = 400MM BETWEEN 1/C POWER CABLE AND COMMUNICATION CABLE. = 300MM BETWEEN MULTICORE POWER CABLE & COMMUNICATION CABLE.		

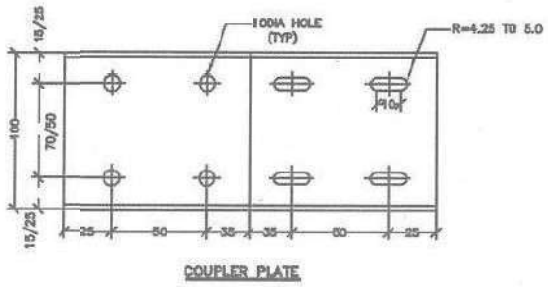
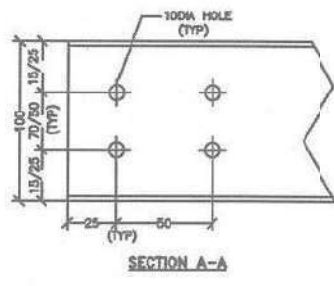
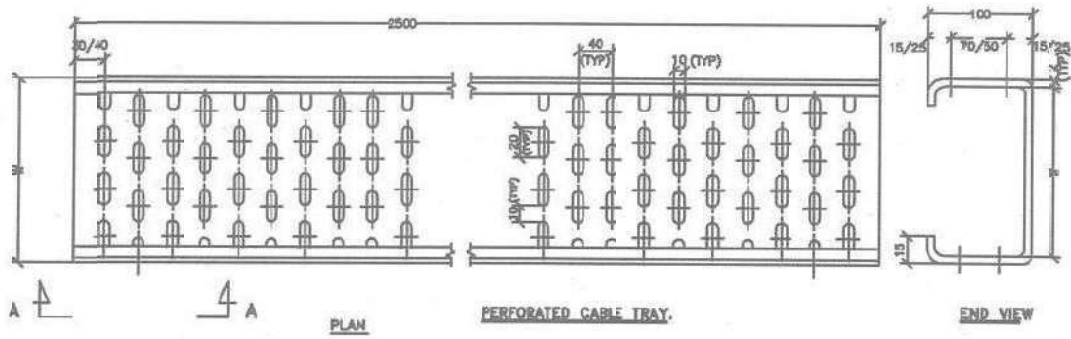
d - OVERALL DIAMETER OF THE BIGGER OF THE TWO CABLES.
D1 - MINIMUM DEPTH OF LAYING FROM GROUND SURFACE TO TOP OF CABLES.

NOTE


1. SINGLE CORE CABLES SHALL BE RUN IN TREFOIL FORMATION AND SHALL BE BOUND BY SELFLECKING CABLE TIES AT EVERY 750 MM.
2. CABLE IDENTIFICATION TAG SHALL BE TIED AT BOTH ENDS OF THE CABLE.
3. IF THE MINIMUM CLEARANCE AS INDICATED THE ABOVE TABLE FOR CABLES OF DIFFERENT CLASSES ARE NOT FEASIBLE BRICK BARRIERS SHALL BE USED BETWEEN ADJACENT CABLES.
4. G.I/HUME/HDPE. PIPES SHALL BE PROVIDED FOR ROAD CROSSING AT A MINIMUM DEPTH OF 600 FROM THE GRADE LEVEL AS DECIDED BY NTPC.
5. ALL DIMENSIONS ARE IN mm

RC	FOR TENDER PURPOSE	1/3	1/3	RJR	-	W	-	-	-	-	AS	05/10
RB	FOR TENDER PURPOSE	RKG	RKG	SJ	-	SS	-	-	-	-	AS	20.11.2006
RA	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	-	-	17.01.2000
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHD	M	E	C	G&I	ARCH	APPD	DATE	
CLEARED BY												
एन टी पी सी NTPC		NTPC LTD. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION										
PROJECT		STANDARD										
TITLE		BURIED CABLES TRENCH FOR HT & LT CABLES										
SIZE A4	SCALE NTS	DRG. NO. 0000-211-POE-A-060								REV. NO. RC		

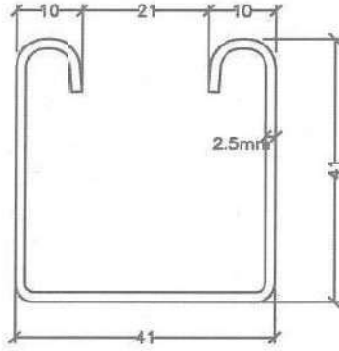
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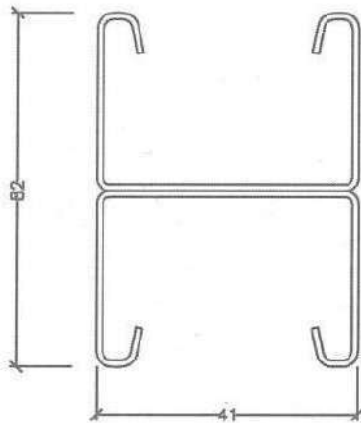
- NOTES.
1. ALL DIMENSIONS ARE IN mm.
 2. MATERIAL--2mm THICK, MS SHEET.
 3. FINISH :-HGT DP GALVANISED
 4. THICKNESS--3mm COUPLER PLATE
2mm TRAY.
 5. TOLERANCE--AS PER RELEVANT I.S.
 6. INNER WIDTH (W) :- 150, 300 & 600mm.

RD	FOR TENDER PURPOSE	RD	MS	REV	-	WV	-	-	-	AS	05.02.10
RC	FOR TENDER PURPOSE	DL	DL	SS	-	RA	-	-	-	AS	05.07.08
RB	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	-	17.04.08
RA	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	-	17.04.08
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH	APPD	DATE
					CLEARED BY						
		NTPC LTD. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION									
PROJECT		STANDARD									
TITLE		PERFORATED TYPE CABLE TRAY.									
SIZE	SCALE	DRG. NO.							REV. NO.		
A4	NTS	0000-211-PQE-A-002							R.D		

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SINGLE CHANNEL-TYPE C1



DOUBLE CHANNEL-TYPE C2

TWO LENGTHS OF C1 WELDED BACK TO BACK

NOTES.

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL :- 2.5mm. THICK MS SHEET.
3. TOLERANCE :- AS PER RELEVANT IS.
4. FINISH :- HOT DIP GALVANISED

RC	FOR TENDER PURPOSE	M2	M2	DR	-	VV	-	-	-	-	AS	05/07/20
RB	FOR TENDER PURPOSE	DL	DL	SS	-	RA	-	-	-	-	AS	05/07/20
RA	FOR TENDER PURPOSE	-	-	-	-	-	-	-	-	-	-	07/08/2000
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&C	ARCH	APPD	DATE	
CLEARED BY												
एन टी पी सी NTPC		NTPC LTD. (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION										
PROJECT		STANDARD										
TITLE		C1 & C2 CHANNEL, CABLE TRAY SUPPORT SYSTEM										
SIZE	SCALE	DRG. NO.		0000-211-PDE-A-013						REV. NO.		RC
A4	NTS											

PART-B
VOLUME – II
CHAPTER – II-E8
DIESEL GENERATOR

TECHNICAL REQUIREMENTS

DIESEL GENERATORS

1.00.00

CODES AND STANDARDS

DIESEL ENGINE	IS -10000, BS- 5514
INTERNAL COMBUSTION ENGINES (12 PARTS)	IS -10000
SPEED OF DIESEL GENERATOR	BS649 / 195B
ALTERNATOR	IS-4722/IEC-60034, IS12065, IS12075
PERMISSIBLE LIMITS OF NOISE LEVEL OF ROTATING MACHINES	IS 12065
MEASURE, EVALUATION AND LIMIT OF VIBRATION SEVERITY OF ROTATING ELECTRICAL MACHINES SHAFT 65 MM DIA OR HIGHER	IS 12075
DIESEL FUELS – SPECIFICATIONS	IS1460
RECOMMENDED PRACTICE FOR HOT-DIP GALVANIZING OF IRON AND STEEL	IS 2629
METHODS FOR TESTING UNIFORMITY OF COATING OF ZINC COATED ARTICLES	IS 2633
CODE OF PRACTICE FOR FIRE – SAFETY	IS 3034
RECIPROCATING INTERNAL COMBUSTION ENGINES	ISO 3046
OSID STANDARD ON LIGHTENING PROTECTION	OISD-GDN-180

1.01.00 The installation work shall conform to Indian Electricity Act and Indian Electricity Rules as amended up to the date this specification is issued. Any approval required from statutory authorities shall be obtained by the Contractor. Nothing in this specification shall be construed to relieve the Contractor of this responsibility.

1.02.00 Equipment complying with other internationally accepted standards such as ASA, IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent to or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted and also furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments in force as on date of opening of bid. Bidder shall clearly bring out the salient features for comparison.

2.00.00 TYPE

Diesel Engine Stationary type, turbo charged and water cooled.

TECHNICAL REQUIREMENTS

3.00.00 TECHNICAL REQUIREMENTS

a)	Ambient temperature	50 degree. (to be considered for deration of alternator)
b)	Relative Humidity	100%
c)	Fuel	HSD Fuel as per IS 1460
d)	Rated Speed	1500 rpm
e)	Governor(Electronic Type)	A1 type as per BS:5514
f)	Vibrations	Max. 250 microns peak to peak with anti-vibration pads
g)	Starting	Electrical self starting
h)	Fuel service tank	990 litres
i)	Air intake system	Dry type air filter, 15 micron size or better with 90% efficiency or better
j)	Cooling	Forced water cooled for Engine & Air cooled for Alternator.
k)	Paint Shade	Grey RAL9002

4.00.00 GENERAL

- 4.01.00 The sizing criteria for the emergency DG set is given in General electrical requirement in General Specification.
- 4.02.00 The emergency DG set shall come in to operation in the event of total power failure in the station.
- 4.03.00 DG set including stack height, acoustics, air emission and fuel oil installation shall meet the requirement given by gazette notifications of Ministry of Environment & Forest time to time , CPCB guidelines, all statutory requirement of Govt. of India and State Pollution Board Guidelines & as updated as on date of bid opening. Necessary lightening protection shall be provided by the bidder for the stack as per statutory and safety requirements. Bidder shall furnish the detailed break-up for arriving at the capacity of the DG set and also furnish overload capacity with a variation in ambient temperature.
- 4.04.00 DG Set shall be located inside acoustic enclosure and suitable for outdoor duty .The exhaust shall be discharged through a silencer & stack at a sufficient height.
- 4.05.00 The generating set shall be suitable placed and enclosed so as to meet the technical, functional and statutory requirement like Noise level, IP protection etc.
- 4.06.00 Critical speed of the machine shall not be lesser than 120% of the normal speed.
- 4.07.00 All couplings shall be capable of withstanding the maximum generator sudden short circuit torque.
- 4.08.00 Necessary ducting, piping, valves, drains, etc. shall also be provided.
- 4.09.00 Maintenance and erection tools and tackles for all the equipment shall be provided by the bidder.
- 4.10.00 The DG set shall be capable of starting largest size of emergency 415 V drive (motor) having starting KVA/rated KW ratio of 8 (higher if starting current is more than 8) and starting power factor of 0.2 with terminal voltage drop being restricted to 15%. Generator loading before starting of this motor shall be considered as 50% of generator rating.

TECHNICAL REQUIREMENTS

4.11.00 The DG set shall also be able suitable for 12 hours continuous running of which one hour at 10% overload at rated speed..

4.12.00 BHP rating of the engine shall be Limited-time running Power (LTP) as per ISO 8528-1 considering deration for 50 deg C ambient temperature

5.00.00 DUCTING, PIPING VALVES AND FITTINGS

5.00.01 The engine shall be supplied with all necessary silencer, exhaust, piping, valves and fittings the fuel oil, lubricating oil, engine starting, air inlet and engine exhaust system, along with expansion joints, drain plugs, flanges and their support structure etc.

5.00.02 Necessary starters for ventilation fans/ exhaust fans / accoustic enclosure and priming pump motors etc. shall be in the scope along with necessary AC distribution board, cables and cabling. Distribution board shall be metal enclosed, compartmentalised, wall/structure mounted and shall be fabricated out of cold rolled sheet steel of thickness 1.6mm with degree of protection of IP-54. The same shall be provided inside the acoustic enclosure

6.00.00 OPERATIONAL REQUIREMENTS

6.01.00 Starting and Control.

1.01.01 All DG Sets shall be controlled independently through separate control panel. It shall also have auto initiation through a 'No volt relay 'and' Auto position of auto/manual selector switch. It shall also have auto initiation through command from remote panel/ central control room.

1.01.02 The starting time required from the initiating signal until the operating speed and voltage is attained and the engine and generator are ready to take load, shall not be greater than 30 seconds. Three attempt starting facility shall be provided either by using two impulse timer and a summation timer or by using microprocessor based controller along with auxiliary panel if any. The DG set shall lockout automatically in case of failure of above. The DG shall be capable of being stopped manually from remote as well as local. Interlock shall be provided in DG control panel to prevent shutting down operation (when in auto mode) as long as the circuit at generator output is closed.

1.01.03 For electrical self starting system, the source of energy shall be batteries backed up by battery chargers which shall be supplied

1.01.04 The starter motor shall conform to IS: 4722.

1.01.05 The fuel oil system and the lubricating oil shall also start operating simultaneously and automatically as soon as a starting impulse is received to obviate any chance of seizure of the piston and bearing as well as air locking in fuel supply system.

6.02.00 Battery and Battery Charger

6.02.01 The battery for starting the engine shall be capable of performing six (6) normal start without recharging Battery and battery charger shall also feed the control supply of DG control panel. The minimum voltage at the end of load cycle shall not be less than 1.75 volts per cell.

6.02.02 A suitable battery charger shall be housed inside the panel to recharge the battery within ten hours. The battery charger shall be SMPS based automatic and shall be complete with DC voltmeter and Ammeter, Float / Boost selector switch Auto / Manual selector switch for Boost to float change over. The charger shall have necessary filters

TECHNICAL REQUIREMENTS

to reduce the ripple factor less than three (3) and suitable dropping characteristics by means of choke and/ or suitable input transformer impedance to automatically reduce the charging current as the battery gradually charges up.

6.02.03

The battery shall be of at least 24V 360 AH or 2 sets of 2 numbers of 12 V, 180 AH battery connected in parallel and shall conform to the requirements of IS : 7372 /IEC:60095. The battery with Polypropylene containers meeting the other technical requirements of IS: 7372 may be acceptable

7.00.00

DIESEL GENERATOR CONTROL PANEL

- i. The local control panel shall be of robust construction, floor mounting, free standing type made of 2.0 mm thick CRCA sheet steel including doors and Partition. The control panels shall have IP-54 degree of protection as per IS: 13947 Part-I.
- ii. The Gland plate shall be of at least 2.5mm thick sheet steel.
- iii. Control panel with provision for local starting shall be provided. This shall incorporate all controls required for starting, monitoring, regulating and stopping DG set.
- iv. All cables shall be bottom entry. Enough space shall be provided in the control panel for easy access during maintenance and repairs.
- v. A tinned copper/ aluminium busbar of adequate dimension shall be provided for earth connection complete with nuts and bolts as required for external connection to earth grid.
- vi. The identification tag shall be white in colour shade RAL 9010.
- vii. CT shorting links, test terminal blocks etc. shall be provided. Panel shall be provided with panel illumination lamp operated by the door switch and thermostat-controlled space heater. Control panel shall be furnished complete with all accessories and wiring for safe and trouble free operation of the system.

TECHNICAL REQUIREMENTS

7.01.00 The Control panel shall be complete with the following

(i) Microprocessor base control unit

Microprocessor base control unit with following.

- (a.) Voltage sensing mains supply failure monitor
- (b.) Auto engine start / stop & failure to start lock out.
- (c.) Generator voltage & frequency sensing
- (d.) Selector switch and push button to facilitate remote starting/stopping, speed & voltage control
- (e.) Manual / Auto / Test selector switches
- (f.) DG start /stop push button
- (g.) DG Incomer Breaker close / trip push button
- (h.) Mains breaker close / trip push button
- (i.) Auto manual Speed adjustment
- (j.) Auto manual Voltage adjustment
- (k.) Auto manual selector switch for priming pump motor (if required)

(ii) LED indication lamps

LED indication lamp shall be provided for the following:- 'DG ON' indication lamp', DG Breaker ON' indication lamp, 'Mains ON' indication lamp, 'Mains Breaker ON' indication lamp, Charger ON indication lamp.

(iii) Annunciation

Annunciation for the following shall be provided with fault indication, alarm & trip contact, accept, reset and test facility. Any one or more of the following defects shall cause the alarm or running diesel generator to be tripped. In case of tripping, re-start

TECHNICAL REQUIREMENTS

shall be prevented until the fault(s) are removed and manual resetting is done. Separate indicators shall be provided for each of the following in control panel:

- (a.) Engine fails to start(Alarm)
- (b.) Low lube – oil pressure.(Trip)
- (c.) High cooling water temperature.(Trip)
- (d.) D.G. overload.(Alarm)
- (e.) DC failure
- (f.) DG over speed(Trip)
- (g.) Fuel level low in day tank(Alarm)
- (h.) Fuel level very low in day tank(Trip).
- (i.) Generator stator temperature high.(Alarm)
- (j.) Electrical protection operated.(Trip)
- (k.) Incomer to emergency switchgear from DG closed.
- (l.) Earth fault (alarm) input from switchgear.
- (m.) Lub Oil Priming Pump 'Fault' indication (if applicable)

(iv) Metering

Following meters shall be provided in the panel: AC voltmeter, AC Ammeter, Frequency meter, Electronic Kwh meter with counter display, KW meter, PF Meter

- 7.03.00 Suitable 4-20mA transducers with dual output shall be provided in the control panel for voltmeter & frequency meter readings at remote use.
- 7.04.00 In addition, coupling relays (with diodes) having 24V DC or suitable energising coil in the control panel shall be provided for remote application for the followings: DG Start, DG Stop, DG Voltage raise, DG voltage lower, DG speed raise, DG speed lower, DG auto start
- 7.05.00 For issuing simultaneous start command to standby DG set, there shall be set of three (3) aforesaid coupling relays in case of standby DG set.
- 7.06.00 Provision for following status/ signal shall also be provided in the DG control panel: DG fail to start, DG start command actuated/ reset, DG working/ stop signal, DG trouble/ normal signal, DG control supply failure/ normal signal.
- 7.05.00 The requirement of CT, VTs, relays, timers, auxiliary contacts shall be as per the system requirement.
- 7.06.00 The bidder shall supply any other controls and indications for diesel generator set though not specifically mentioned here but which the supplier may recommend and are required to make system complete for satisfactory operation of DG sets.
- 7.07.00 Necessary pressure switches, level switches, thermostats, flow switches, auxiliary relays, etc. required for the above alarm and annunciation system shall be furnished under the scope of this specification.

TECHNICAL REQUIREMENTS

8.00.00 DIESEL ENGINE

8.01.00 Construction Features

- (a) Diesel engine shall be mounted on visco damper type vibration dampening system or equivalent anti-vibration mounting system (as recommended by Engine manufacturer) and shall be complete with integral air intake through dry type air filters and exhaust systems, metering facility, speed regulation system, fuel injection system, lube oil system, primary cooling water system along with necessary filters, silencers, ducts, exhaust, piping and fittings, valves, instruments, etc. as required.
- (b) The generating unit shall be complete with all auxiliaries and its performance, torsional vibration, materials and workmanship, etc. shall be in accordance with the standard practices of diesel engine manufacturer's association in USA. IS-10000, BS-5514. The engine shall be properly balanced so as to transmit only small unbalanced forces to the foundation.

8.02.00 DIESEL OIL SYSTEM

- (a) The diesel oil system as provided shall be complete with simplex type filters, hoses, piping, fittings, relief valves, supports, control and instrumentation and all other accessories to make it complete.
- (b) The fuel consumption of the engine at full and three quarters of its rated power output shall be indicated.
- (c) A day oil tank of 990 litres fuel capacity shall be provided, mounted on fabricated steel platform outside the acoustic enclosure. The tank shall be complete with level indicator marked in Litres, two nos. of level switches, filling inlet with removable screen, an outlet, a drain plug, an air vent and necessary piping. The fuel tank shall be painted with oil resistant paint. All pipe joints shall be brazed/ welded.

8.03.00 Lubricating oil System

- (n.) Automatic pressure lubrication shall be provided by a shaft driven gear type pump through an oil cooler and fin mesh filters to the end bearing, camshaft bearings, camshaft chain and gear drives, governor, air starting, distribution, auxiliary drive gears etc.
- (o.) Hand driven and/ or A.C. motor driven lube oil priming pump (if applicable) along with starter is to be provided as recommended by the engine manufacturer.
- (p.) All necessary accessories like pressure gauges, temperature and oil level indicators, pressure relief valves, bypass valves, pressure switches for alarm and control shall be furnished together with all inter connecting piping, fittings, supports, valves, etc.
- (q.) A lubricating oil filter shall be provided for operation under normal conditions for period of a more than 250 hours without the necessity of its replacement or cleaning.

8.04.00 Cooling System

In case, Jacket water cooling system is offered, same be in closed cycle and shall have radiator located in front of the engine with a fan driven mechanically from the engine

TECHNICAL REQUIREMENTS

shaft. Forced water circulation by means of pump driven by the engine shaft shall be employed. The radiator tubes shall be of copper with sufficient heat transfer area.

8.05.00 Governing System

- (a) The governor shall be electronic type with class A1 type as per BS-5514.
- (b) The governor shall have necessary characteristics to maintain the speed substantially constant even with sudden variation in load. However a tripping shall be provided even if speed exceeds the maximum permissible limit.

8.06.00 Ancillary Equipment

All ancillary equipment which are necessary for proper operation and maintenance of the set and safety of operating personnel shall be provided as per system requirements.

9.00.00 GENERATOR

- i) The generator shall be of totally enclosed or screen protected drip proof and self air cooled type. The generator shall be driven by the Diesel engine in this specification and shall match the same in all respects. The generator shall conform to IEC-60034.
- ii) AC generator shall be supplied along with it's excitation system, AVR and include all necessary auxiliaries.
- iii) Rating
The Generator shall be star connected 3-phase, 50 Hz synchronous generator and shall have a continuous rating. The operating condition for each electric generator shall be as follows:
 - a) Voltage : 415V
 - b) Frequency : 50 C/S (+3 to-5%)
 - c) Power factor : 0.8
- iv) Insulation and Temperature Rise of Windings and Core
All insulated winding conductors of alternator shall be of copper. The generator stator and rotor windings core insulation and all connections including main and neutral leads shall have insulation conforming to IEC-60034-Pt1. The winding shall be given power house treatment (i.e. two coats of varnish and backing followed by final coat of resin). The total insulation shall be non hygroscopic. The temperature rise of the stator core and mechanical parts in contact with or adjacent to winding shall not exceed the specified limits of IEC-60034-Pt1.
- v) Space heaters of suitably rated 240 V, single phase, 50 Hz, located in lower part of alternator shall be provided..
- vi) Separate terminal boxes shall be provided for phase and neutral side of leads. The terminal boxes shall having degree of protection of IP-54 as per IS: 13947.
- viii) Alternator vibration level shall not exceed the values as defined in IS:12075. Alternators in case driven by Diesel engine shall be able to withstand vibration level of 9mm/sec. as per BS 5000 Part III. Vibration level shall not exceed the permissible levels for Generator however the same shall in any case not exceed 250 micron peak to peak.
- ix) Resistance element temperature detector shall be installed in stator windings and in each bearing. The RTD's shall comply with the latest edition of IS:2828.

TECHNICAL REQUIREMENTS

- x) The generator shall be complete with voltage transformers necessary for AVR/ Synchronisation
- xi) The Main Phase side terminal box shall be suitable for terminating LT bus ducts/cable. The sizing of the same shall be as per system requirements.
- xi) The neutral point shall be brought to DG control panel and shall be connected to 300/110V VT, to be supplied and mounted inside the DG control panel by the bidder for earth fault detection.

9.01.00 Excitation System

The generator shall be provided with complete excitation system capable of supplying the excitation current of the generator under all conditions of output from no load to full load and capable of maintaining voltage of the generator constant within +/- 1% of set value. The setting range available on voltage regulator shall be at any value with +/- 10% of the rated voltage. It shall be possible to set the same from remote also.

10.00.0 SOUND PROOFING SYSTEM

- 1) The sound absorptive layer shall comprise of bonded type mineral wool/glass wool of adequate thickness and density to comply the design requirements.
- 2) DG shall be placed in acoustic enclosure. The requirements of acoustic enclosure are as following:
 - a. The acoustic enclosure shall be fabricated from 2.0 mm thick CRCA sheet with steel section & frame of suitable size. The enclosure shall be suitable for outdoor duty. The sheet and all sections shall be powder coated shade of grey RAL9002. A minimum clear space of 800mm shall be kept inside the enclosure. Necessary acoustic sealing shall be done in the panels/ modular unit joints.
 - b. Enclosure shall be provided with adequate lighting. Enclosure shall be provided with adequate number of door and viewing glass.
 - c. Suitable louvers with acoustic treatment shall be provided as required.
 - d. Ventilation system of adequate capacity shall be provided. The construction of ventilation duct shall be from 1.6 mm thick CRCA perforated sheet. The ventilation system shall be design to prevent leakage of sound and temperature shall not increase by more than 5 degree centigrade when DG is running continuously at specified rating
 - e. The acoustic enclosure shall have suitable opening for routing out of cable/bus ducts from alternator terminal box. Further suitable acoustic treatment of the opening shall be done to achieve the desired acoustic level.

TESTS:

11.00.0 TYPE TESTS

TECHNICAL REQUIREMENTS

11.01.00 Type test reports for the following type tests shall be submitted:

11.01.01 Type test reports on Engine

This shall be as per ISO 3046 (Table-1)

11.02.0 Type test reports on Alternator

1. Measurement of resistance
2. Phase sequence test
3. Regulation test
4. Measurement of open circuit and short circuit characteristics
5. Efficiency test
6. Temperature Rise Test
7. Momentary overload test
8. Over speed test
9. High Voltage test
10. Insulation resistance test (both before and after High Voltage Test)
11. Noise level as per IS:12065
12. Vibration as per IS: 12075.
13. Determination of Deviation of voltage waveform from sinusoidal.
14. Degree of protection test on control panel for IP-52

12.00.0 COMMISSIONING CHECKS

In addition to the checks and test recommended by the manufacturers, the contractor shall supervise the following commissioning test to be carried out on each set at site.

The battery or compressed air system for starting the engine shall be capable of performing six (6) normal start without recharging.

TECHNICAL REQUIREMENTS

12.01.00 Load Test

The engine shall be given test run for a period of at least 6 hours. The set shall be subjected to the maximum achievable load as decided by Project Manager without exceeding the specified DG set rating.

During the load test half hourly records of the following be taken:

15. Ambient temperature.
16. Exhaust temp. if exhaust thermometer is fitted.
17. Cooling water temp. at a convenient point adjacent to the water output from the engine jacket.
18. Lubricating oil pressure.
19. Speed.
20. Voltage, wattage and current output.
21. Oil tank level.

12.02.00 Insulation Resistance Test for Alternator

Insulation resistance in mega-ohms between the coils and the frame of the alternator when tested with a 500 V megger shall not be less than $IR = 2x$ (rated voltage in KV) + 1.

12.03.00 Check of fuel consumption

A check of the fuel consumption shall be made throughout the load run test. The fuel consumption should not exceed the design values.

12.04.00 Insulation Resistance of Wiring

Insulation resistance of control panel wiring shall be checked with 500V megger. The IR shall not be less than one mega ohm.

13.00.00 FUNCTIONAL TESTS

Following functional tests are to be carried out at site:

- 13.01.00 Functional tests on control panel.
- 13.02.00 Functional tests on starting provision on the engine.
- 13.03.00 Functional tests on all field devices.
- 13.04.00 Functional tests on DG Set complete with AVR and speed governor.

14.00.00 MEASUREMENT OF VIBRATION

The vibration shall be measured at no load and at load as close to maximum achievable load and shall not exceed 250 microns. Any modification/rectification required to bring

TECHNICAL REQUIREMENTS

down the vibration level with in allowable limits specified by the manufacturer shall be done by the bidder. Vibration test is to be carried out at site.

15.00.00 Noise Level (Sound Pressure Level) Check

Noise level measurement shall be done generally following the guidelines given in IS: 12065. The measurement shall be carried out with a calibrated integrating sound level meter as per IS: 9779. This test is to be carried out at site.

16.00.00 INSTALLATION OF DG SETS

The installation, testing and commissioning of Diesel-Generator sets including all the accessories/equipment as required shall be carried out strictly in accordance with the applicable Codes of practice, statutory requirements the manufacturer's instructions, drawings etc.,

The Contractor shall provide all tools, equipments and instruments required for installations, testing and commissioning.

PART-B
VOLUME – II
CHAPTER – II-E9
MV SWITCHGEARS

TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

a)	IS: 722	AC electricity meters.
b)	IS: 996	Single phase small AC and universal electrical motors.
c)	IS: 1248	Direct Acting indicating analogue electrical measuring instruments and Accessories.
d)	IS/IEC: 60947	Degree of protection provided by enclosures for low voltage switchgear and control gear.
e)	IS: 2544	Porcelain post insulators for systems with nominal voltages greater than 1000 Volts.
f)	IS: 2705	Current transformers.
g)	IS: 3156	Voltage Transformers
h)	IS: 6005	Code of practice for phosphating of iron and steel.
i)	IS: 3427	Metal enclosed switchgear and control gear
j)	IS: 5082	Specification for wrought aluminum and aluminum alloy bars, rods, tubes and selections for electrical purposes.
k)	IEC: 61850	Communication Standard for Numerical relays
l)	IEC: 61131-3	Automation Standard for Numerical relays
m)	IS: 9046	AC contactors for voltages above 1000 volts and upto and including 11000 Volts.
n)	IS: 13703	Low voltage fuses
o)	IS: 9385	HV fuses
p)	IS: 9431	Specification for indoor post insulators of organic material for system with nominal voltages greater than 1000 volts upto and including 300 kV
q)	IS: 9921	A.C. disconnectors (isolators) and Earthing switches for voltages above 1000 V
r)	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.
s)	IS: 13118	Specification for high voltage AC circuit breakers.
t)	IEC: 60099-4	Metal oxide surge arrester without gap for AC system
u)	IEC: 62271-100	High voltage alternating current circuit breakers.
v)	IS/IEC: 62271-200	High voltage metal enclosed switchgear and control gear.
w)	IEC: 60947-7-1	Terminal blocks for copper conductors
x)	IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips
y)	IS:15652/IS:2584	Dielectric epoxy-based coating for electrical purposes

1.00.00 2.00.00 TECHNICAL PARAMETERS

a) SYSTEM PARAMETERS			
1	Nominal System voltage	11 kV	3.3 kV
2	Highest System voltage	12 kV	3.6 kV
3	Rated Frequency	50 Hz	50 Hz
4	Number of phases/ poles	Three	Three

TECHNICAL REQUIREMENTS

5	System neutral earthing	Earthed through Resistance to limit fault current to 600 A		
6	One minute power frequency withstand voltage			
	- for Type tests	28	10	
	- for Routine tests	28	10	
7	1.2/50 microsecond Impulse withstand voltage	75 kV (peak)	40 kV(peak)	
8	Maximum system fault level including initial motor contribution	50 kA (rms)	40 kA (rms)	
9	Short time rating for bus bars, ckt. breakers, current transformers and swgr. Assembly.	50 kA (rms) for one (1) sec.	40 kA (rms) for one (1) sec.	
10	Dynamic withstand rating	125 kA (peak)	100 kA (peak)	
11	IAC Rating	40 kA, 1 sec (As per IEC 62271-200)		
12	Maximum ambient air temperature	50 deg. C	50 deg. C	
b) BUS BARS				
1.	Continuous current rating at 50°C ambient:	As Per System requirements		
2.	Material	High Conductivity Al/Copper		
2.	Temper Rise allowed above ambient	40°C for plain joints 55°C for Silver plated joints		
3.	Sleeves	Non-Halogen Based Heat Shrinkable polyolefinic sleeves		
c) SWGR. CUBICLE CONSTRUCTIONAL REQUIREMENTS				
1.	Cable entry			
	a)	Power Cables	Bottom	
	b)	Control Cables	Bottom	
2.	Busduct entry	Top		
3.	Earthing conductor	Galvanized steel strip		
4.	Service Continuity of swgrs(as per IS/IEC 62271-200)	LSC2B-PM		
5.	Degree of Protection	IP 5X for relay compartment, IP4X for remaining compartment		
6.	Material	Enclosure: Rolled steel/Alu Zinc Door/covers:2mm CRCA Gland Plate:2.5mm (Hot/cold Rolled steel), 3mm(non magnetic)		

TECHNICAL REQUIREMENTS

7.	Type of cooling	Natural air flow up to 3000A Forced cooling above 3000A	
8.	Safety Shutter	As per IEC 62271-200	
d) CIRCUIT BREAKERS			
1.	The circuit breakers current rating shall be selected from the load current given in SLD which is at an ambient of 50 ⁰ C.		
2.	Type	Vacuum type Anti pumping Electrical & Mechanical	
3.	Short circuit breaker Current	11 kV	3.3 kV
	a) A.C. component	50 kA	40 kA
	b) D.C. component	As per IS: 13118 or IEC-62271	
4.	Short Circuit making current	125 kA (peak)	100 kA (peak)
5.	Operating Duty	O-3min-CO-3min-CO	
6.	Total break time	Not more than 4 cycles	
7.	Total make time	Not more than 5 cycles	
8.	Operating Mechanism	Motor wound spring charged stored energy type as per IEC-62271	
9.	Control supply voltage	Closing coil/spring charging motor 220/110 V DC (-15/+10%) Tripping coil 220/110 V DC(-30/+10%)	
e) CURRENT TRANSFORMER			
1.	Secondary Current	1A	
2.	Class of Insulation	Class E or better	
3.	Rated output	Adequate for the relays and devices connected, but not less than five (5) VA.	
4.	Accuracy class		
	Protection	Class PS for differential, REF and Core Balance CTs (CBCT); 5P20 for other protection CTs	
	Measurement	0.2s for Station & Unit Incomers and any other defined feeders as marked in SLD.	
5.	Minimum primary earth fault current to be detected by CBCT	3 Amperes	
6.	CBCT	50/1 A, Single, circular window type CBCT for each outgoing motor and transformer feeder	
6.	Instrument Security Factor for Measurement CTs	5	
f) VOLTAGE TRANSFORMERS			
1.	Rated Voltage Factor	1.2 continuous for all VTs, and 1.9 for 30 seconds for star connected VTs.	
2.	Class of insulation	Class E or better	

TECHNICAL REQUIREMENTS

3.	Other parameters	BUS PT-0.5 Class,VA req. adequate for application. Line PT-0.5 Class for sync./3P for door interlocks, VA req. adequate for application.	
g) H.V. FUSES			
1.	Voltage class	3.3kV	
2.	Rupturing Capacity	Adequate for 100 kA (peak)	
3.	Rated current	As per application	
h) SURGE ARRESTERS (FOR MOTOR FEEDERS)			
		11 kV	3.3kV
1.	Nominal discharge Current (8x20 μ s)	5kA	5kA
2.	Continuous Operating Voltage	12 kV	4.5 kV
3.	Max allowable Residual voltage at nominal discharge current	40 kV	15kV
4.	Mounting	Inside panel	Inside panel
i) CONTACTORS :			
1.	Nominal Voltage	System	3.3kV
2.	Highest Voltage	System	3.6kV
3.	Rated Frequency	50 HZ	
4.	Rated Continuous Current at 50°C ambient	Current rating shall be selected appropriate for the load current	
5.	Control Supply Voltage	240V DC / 120V DC unearthed	
6.	Utilisation category	AC-3	
7.	Type	Vacuum, HRC fuse backed mechanically latch type contactor for conveyor & crusher motor feeder panel(CC)	
8.	Control Supply Voltage	Closing Coil 220/110 V DC (-15/+10%) Trip Coil 220/110V DC(-30/+10%)	
j) Earthing and Earthing devices			
1.	Material	Copper/Galvanized steel with adequate cross-section to carry the momentary short circuit fault current to Earth	

TECHNICAL REQUIREMENTS

2	Earthing Truck or mechanism	or	Bus/ Line side earthing truck or mechanism of each type rating & size to be provided at individual switchgear room
k) Control terminal blocks			
1.	Rating	650V grade, 10 A ,6.6 polyamide UL 94	
2.	Type	Screw less, push in technology (IEC 60947-7-1 and UL certified)	
l) Switchgear Wiring			
1.	Rating & size	650 V grade, single core 2.5 sq. mm cu for CT connection 1.5 sq. mm cu for others	
m)	Dielectric epoxy based coating	As per IS:15652/IS:2584	

2.00.00

3.00.00

3.00.00 GENERAL TECHNICAL REQUIREMENTS

- (a) The switchgear boards shall have a single front, single tier, fully compartmentalized, metal enclosed construction complying with clause No. 3.102 of IEC 62271-200, comprising of a row of free-standing floor mounted panels.
- (b) Suitable trolley shall be provided by the Contractor for withdrawal and insertion of the breaker truck from and into the (in case of truck roll out on telescopic rails)
- (c) Circuit Breaker/Contactor rack-in and rack-out from Service to Test, Test to Isolated position, or vice-versa shall be possible only in the compartment door closed condition and compartment door shall not open while circuit breaker/contactors is in Service position.
- (d) All insulating components being used in panel shall be Flame Retardant as per UL-94 V0 flammability standard.
- (e) Suitable base frames made from steel channels shall be supplied along with necessary anchor bolts and other hardware, for mounting of the switchgear panels. These shall be dispatched in advance so that they may be installed and leveled when the flooring is being done, welding of base frame to the insert plates as per approved installation drawings shall be in Contractor's scope.
- (f) The switchboard shall have the facility of extension on both sides. Adopter panels and dummy panels required to meet the various busbar arrangements, cable / busduct termination and layouts shall be included in Contractor's scope of work.
- (g) **Rear Cover Safety Interlock Requirements:**
 - i. Busbar compartment cover of any panel can be opened only if the incomer/tie /bus-coupler (i.e. incoming sources) are in isolated position and busbar is in de-energized condition. Inversely, incomer/tie /bus-coupler (i.e. incoming sources) can be closed only if all the Busbar compartment covers are closed.
 - ii. Cable/Bus-duct compartment cover (Line Side) of Incomer/Tie can only be opened while upstream (source) breaker is in isolated position and line is dead. Inversely, upstream(source) breaker can be closed only if Cable/Bus-duct compartment cover (line side) of downstream side Incomer/Tie panel is closed.
 - iii. The cable compartment cover of any panel can be opened only when circuit breaker of that panel is in isolated position. Inversely, the circuit breaker can be closed only if subject cable compartment cover is closed.
 - iv. LED must be mounted on the rear side of panel indicating " RED" while breaker is on and in-service condition.
- (h) Wireless temperature monitoring system to be provided and same shall be integrated to DDCMIS/ separate HMI. Temperature sensors shall be installed in all relevant joints, contact joints etc. as per the standard OEM Practice, however Position of such sensors shall be decided at the time of detailed engineering.

TECHNICAL REQUIREMENTS

- (i) For EPB circuit(2NO+2NC) in HT drives, one set (1 NO+1NC) contact shall be directly connected in breaker tripping and closing circuit and other set shall be routed through interface relay to DCS. Separate cables and glands shall be provided for 2 different set of contacts.

3.00.01

Dielectric epoxy-based coating for MV switchgear rooms:

clause

Dielectric epoxy-based coating shall be provided for all MV switchgear rooms as per

No-13.00.00 of Part-B sub sec B-0

4.00.00

4.00.00 PROTOTYPE PANELS

In order to establish the compliance with the requirements of this technical specification, prototype panels of each module type shall be made and offered for the Employer's inspection and approval before the start of bulk manufacturing of panels for this project.

5.00.0

TESTS

5.1.00

Type tests

a)	The following type test reports on circuit breaker / circuit breaker panels, of each voltage class and current rating shall be submitted
	1) Short circuit duty test on circuit breaker, mounted inside the panel offered along with CTs, bushing and separators.
	2) Short time withstand test on circuit breaker, mounted inside panel offered together with CTs, bushings and separators.
	3) Power frequency withstand test on breaker mounted in side panel.
	4) Lightning impulse withstand test on breaker mounted in side panel.
	5) Temperature rise test on breaker and panel together. For this test, the test set up shall include three panels with breakers, the test breaker and panel being placed in the centre.
	The adjacent panels shall also be loaded to their rated current capacity. Alternatively the test panel may be suitably insulated at the sides, which will be adjoining to other panels in actual site configuration
	6) Internal Arc Test as per IEC 62271-200
	7) Measurement of resistance of main circuit.
	8) Mechanical operation test.
	9) Degree of protection
b)	The following type tests reports on Contactor and Contactor panels of each type and rating shall be submitted.
	1) Verification of rated making and breaking capacities of the contactor.
	2) Short time withstand test of panel.
	3) Power frequency test on the contactor mounted in side panel.

TECHNICAL REQUIREMENTS

	4)	Lightning impulse voltage withstand test of the contactor mounted in side panel.
	5)	Measurement of resistance of main circuit.
	6)	Test to confirm coordination between fuse and contactor.
c)		Short circuit withstand test of earthing device (truck / switch).

5.2.00 Routine Tests

All acceptance and routine tests as per the specification and relevant standards IEC 62271-200 & IEC 62271-100 shall be carried out.

The manufacturer shall furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

Testing to observe compliance to degree of protection, shall be checked for each switch board enclosure and busbar chambers during routine inspection shall be as under.

(a.) IP -4X It shall not be possible to insert a one (1) mm. dia steel wire into the enclosure from any direction, without using force.

(b.) IP-5X It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.

5.3.00 COMMISSIONING CHECKS / TESTS

Bidder shall submit commissioning test procedure including details of all commissioning check before commissioning the system at site

Note:-

This chapter has to be read in conjunction with sub-section B-0"general electrical specification" of Technical specification Section-VI, Part-B and Sub-Section IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A and Part-E.

TECHNICAL REQUIREMENTS

MV AND LV SWGR - PROTECTIONS, CONTROL AND METERING

1.00.00 SYSTEM DESCRIPTION

1.01.00 SWITCHGEAR NUMERICAL RELAY NETWORKING

Switchgear Numerical Relay network Architecture

- (a) The typical configuration of such a proposed system is as per the enclosed drawing no. 0000-205-POE-A-001 (Overall Architecture of Switchgear Relay Network). The numerical relay network shall include relays on all MV & LV switchgears being supplied under this package. Each ring network shall consist of switchgear level Ethernet switches connected through Fibre Optic cable and subsequently connected to Network Level Ethernet Switches placed in main plant control equipment room (CER).
- (b) The point-to-point testing of all signals of Numerical Relays for the Switchgear network at the DDCMIS and protection equipment (Switchgear) end shall be the responsibility of the contractor.

2.00.00 SYSTEM PERFORMANCE REQUIREMENTS

2.01.00 **Latency:** The system shall be so designed and implemented as to provide data transfer speeds prescribed by *IEC 61850-5*.

2.02.00 **Reliability:** All components shall be designed and configured to make the system highly reliable. Failure of any component shall be immediately announced and wherever possible, the system shall be made self-healing.

2.03.00 **Diagnostic tools:** The system shall have necessary diagnostic tools to continuously monitor the system performance and provide feedback to the operator / engineer. Necessary software tools to track changes in the system shall be provided.

3.00.00 NUMERICAL RELAYS

3.01.00 General requirements

3.01.01 All Numerical relays shall be of types, proven for the application satisfying requirements specified elsewhere and shall be subject to Employer's approval. Numerical Relays shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity for the intended application.

3.01.02 All numerical relays shall be rated for control supply voltage as mentioned elsewhere under system parameters and shall be capable of satisfactory continuous operation between 80-120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used. Threshold voltage for binary inputs shall be suitably selected to ensure avoidance of mal operation due to stray voltages and preferably shall be more than 70% of the rated control supply voltage.

3.01.03 One minute power frequency withstand test voltage for all numerical relays shall at least be 2kV (rms).

3.01.04 All IEDs shall have freely programmable optically isolated binary inputs (BI) and potential free binary output (BO) contacts, the quantity of which shall be adequate to realize the associated interlocks / feedbacks. At least 2 binary inputs (BI) & 2 binary outputs (BO) shall be kept as Spares for Employer's future use.

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- 1.01.00 In case the offered IED does not have the required number of I/Os, the same can be achieved through external I/O device of same make complying with the requirement.
- 3.01.05 Failure of a control supply and de-energization of a relay shall not initiate any circuit breaker / vacuum contactor operation.
- 3.01.06 Disturbance Record waveforms, event records & alarms shall be stored in Non-volatile memory and failure of control supply shall not result in deletion of any of these data.
- 3.01.07 All the numerical relays shall have communications on three ports, one local front port communication to laptop and two rear port on IEC 61850 to communicate with the DDCMIS through LAN.
- 3.01.08 All Numerical relays shall have features for electrical measurements including voltage, current, power (active & reactive), frequency, power-factor and energy parameters.
- 3.01.09 All numerical relays shall have provision of both current (CT) and voltage (VT) inputs. Relays shall be suitable for both residually connected neutral CT input as well as CBCT input. Relays shall be suitable for CT secondary current of 1A. Following minimum no. of CT inputs to be provided in numerical relays used for different type of feeders as mentioned below including phase and neutral CT inputs.

1	DB(MV transformer feeders without differential)	4CT
2	DBF(MV transformer feeders with differential)	7CT
3)	DA(MV motor without Diff)	4CT
4)	DAF(MV motor with Diff)	7CT
5)	DC(MV incomer)	5CT
6)	DD/DE-OG/DE-IC(MV Tie, buscoupler)	4CT
7)	DAET(LT incomer)	4CT
8)	DAE(Buscoupler, Tie)	4CT
9)	DM(ACB Controlled Motor)	4CT
10)	DG I/C	7CT

- 3.01.10 Relays used in incomers, ties and bus couplers shall have provision of two sets of voltage inputs (3Nos for bus voltage & 1No. for line voltage) for the purpose of synchronization.
- 3.01.11 All CT terminals on the relays shall be of fixed type suitable for connection of ring-type lugs to avoid any hazard due to loose connection leading to CT open-circuit. In no circumstances Plug In type connectors shall be used for CT / VT connections.
- 3.01.12 All numerical relays shall have keypad / keys to allow relay setting from relay front. Pre-programmed or programmable key for Master trip (86) reset shall be provided on the relay front.
- 3.01.13 Relays shall have suitable output contact for circuit breaker failure protection (CBFP).
- 3.01.14 Relays shall have self-diagnostic feature with continuous self-check for power failure, program routines, memory and main CPU failures and a separate output contact for indication of any failure.
- 3.01.15 Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI / user-programmable characteristics.
- 3.01.16 Design of the relay must be immune to any kind of electromagnetic interference.

TECHNICAL REQUIREMENTS

3.01.17 All cards/ hardware of numerical relays shall be suitable for operation in Harsh environmental conditions with respect to high temperature, humidity & dust.

3.01.18 Relays of each type/model shall be supplied with same Firmware/Software version for the complete package.

3.02.00 **Protections: Relay Types & Protections**

3.02.01 **Motor Feeder Protections (Module Type DA/DAF/CC/DM)**

The Motor protection relay shall be suitable for providing the following protections

- a) **Thermal Overload Protection (49),**
- b) **Short Circuit Protection (50)**
- c) **Earth Fault Protection (50N)**
- d) **Negative Phase Sequence Protection (46)**
- e) **Locked Rotor Protection (50LR)**
- f) **Motor start monitoring & Restart inhibit feature**
- g) **Number of starts limitation (66)**
- h) **Under Voltage protection with time delay (27M)**
- i) **Motor Differential protection (87M)**
- j) **VT Fuse-fail protection (60)**

3.02.02 **Transformer Feeder Protections (Module Type DB/DBF/CCT)**

The Transformer protection relay shall be suitable for providing the following protections.

- a) **Three Phase Over current and Earth Fault protection (50 & 50N)**
- b) **Transformer Differential protection (87T)**
- c) **Transformer trouble trips**
- d) **Inrush protection function**

3.02.03 **Protections for Incomers, Bus-couplers and Tie feeders (Module Type DC/DE/DD/DAET/DAE)**

The Incomer, Bus Coupler & Tie feeder protection relay shall be suitable for providing the following protections

- a) **Three Phase Over current and Earth Fault protection (50 & 50N)**
- b) **Restricted Earth Fault protection (64R) [Applicable only for DC/DAET]**
- c) **Stand by earth fault protection (51N) [Applicable only for DC]**
- d) **Inrush protection function**
- e) **Synchronizing Check (25)**
- f) **Bus No-volt**

TECHNICAL REQUIREMENTS

3.03.00 Other Protections and Control features

Control of breakers / vacuum contactors shall be carried out from DDCMIS through hardwired control commands in the form of 24V DC signal. All close and trip commands from DDCMIS shall be hardwired through separate coupling relays to BI of numerical relays in form of 220 V

- 3.03.01 DC signal.
- 3.03.02 The tripping of 11/3.3 KV incomers shall follow the reverse blocking logic through both hardwired and GOOSE signals. The reverse blocking signals must be exchanged between tie feeders also through hardwires.
- 3.03.03 For each Station incomer feeders, 51N(SBEF) pickup signals must be hardwired to all tie feeders of the respective power stream using relay's binary outputs or installing a separate Auxiliary relay. The logic /scheme shall be finalised during detail engineering.
- 3.03.04 Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker / contactor trip circuit both in pre-trip and post-trip conditions.
- 3.03.05 Schematics requiring auxiliary relays / timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer functions shall be as required for the application. Timer functions shall be configurable for on & off delays as per requirement.
- 3.03.06 The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker status monitoring, VT and CT supervision.
- 3.03.07 The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery backup for real time clock in the event of power supply failure shall be provided.
- 3.03.08 At least 200-time tagged events / records shall be stored with time stamping. Details of at least 5 previous faults including the type of protection operated, operating time, all currents & voltages and time of fault.
- 3.03.09 Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be provided. The results of the self-reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be available on the user interface.
- 3.03.10 20 Signals (both Analog & Digital) from each relay shall be communicated to DDCMIS on IEC 61850 protocol. Exact signals shall be finalised during detailed engineering.
- 3.03.11 Sequence of events shall have 1ms resolution at device level.
- 3.03.12 Measurement accuracy shall be 2 % for rated RMS Current and voltage
- 3.03.13 It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.
- 3.03.14 All motor feeders(>30KW) shall have min one no. of 4-20mA analog output (current signal) for use in control logics in DDCMIS or for information in DDCMIS.
- 3.03.15 GOOSE Controls shall be configured in the Numerical Relays for following functions. The response time of GOOSE interlocks shall be 10ms. (GOOSE Performance Class P1, Message Type 1A)
 - (a) Inter tripping

TECHNICAL REQUIREMENTS

(b) Reverse Blocking including Hard Wiring

(c) Earthing Interlocks

4.00.00 ETHERNET SWITCH

4.01.00 **Ethernet Switch at Switchgear Level/Network Level:** Ethernet switches shall be 'substation hardened', 19" rack mounted and shall comply with IEC61850 for communications and environment requirements. The Ethernet switches shall be of Layer 2 & managed type with four (4) Nos of Fibre Optic ports fully populated with SFP modules and Sixteen (16) / Eight(8) Copper ports to achieve the LAN configuration indicated in the drawing. These switches shall be mounted inside the switchgear panels and shall be suitable for accepting dual redundant power supplies. The FO ports shall be Single mode 1000Mbps ports. Copper ports shall be 10/100Mbps ports. The switch shall support RSTP/MSTP. The Ethernet Switch shall have feature of MAC binding per port and IEEE 801.1X radius Authentication for Port Security. Switch shall have feature to monitor the Port status over Modbus/SNMP Protocol & Port Configuration through Web Interface.

4.02.00 Necessary software for configuration and real-time network monitoring shall be provided along with the Ethernet switches. Network monitoring feature shall be integrated with the HMI (Switchgear EWS) to provide complete network status.

5.00.00 LAN CABLE & CONNECTOR

5.01.00 Cat5e/Cat6 Ethernet cable shall be used for connecting the numerical relays to Ethernet switches. In case FO ports are proposed on the numerical relays, Ethernet switches shall also have suitable FO ports as per the quantity mentioned above. Further, additional FO patch cords of maximum length (quantity – 10% of total quantity of IEDs) shall be supplied to facilitate maintenance.

6.00.00 FO CABLE & CONNECTOR

6.01.00 The Fibre Optic cable shall be armoured, Single-mode, graded index OMI (ISO/IEC 11801) of Diameter 125µm core / cladding with max attenuation of 1.52 dB/km at 1310nm wavelength & 1.0 dB/km at 1550nm wavelength. The cable should be suitable for operation at 1310/1550nm. The outer Sheath / Jacket of the FO Cable shall be Fire retardant.

7.00.00 Ethernet Switch Box

7.01.00 Ethernet Switch Box shall consist of the following:

(a) Two nos. Ethernet switches (layer-3) at network level for Ring formation and taking data from Numerical relay network (IEC-61850) and providing to DDCMIS(IEC-61850)

(b) At least 2 Nos (1 working + 1 standby) ventilation fans with monitoring

(c) Arrangement for receiving and distributing auxiliary power supply to various equipment / circuits along with monitoring devices for incoming power supply

(d) 1 LED light +1 Power Socket with Switch

(e) Any other equipment / device necessary for completeness of the system

7.02.00 The Network level Ethernet Switches shall be provided to network the various switchgears at different locations through LAN system. They shall also provide gateway between Numerical relays, HMI (Switchgear EWS) and DDCMIS.

8.00.00 HMI (Switchgear Engineering Workstation) and Laptop

TECHNICAL REQUIREMENTS

- 8.01.00 HMI (Switchgear Engineering Workstation) shall consist of industrial grade PC with Laser printer connected to the relay network through Network level switches for online configuration/setting change of relays & ethernet switches. Automatic downloading and saving of the disturbance records & event files from relays through automatic DR download software tools provided by the relay vendors shall also happen in this HMI. All the HMI PCs being offered in the system shall be as per the latest available configurations as on the date of bid opening. The minimum storage capacity shall be 1 TB, minimum RAM shall be 16GB and processor shall be I7/ equivalent or higher. Screen size shall be minimum 24 inches.
- 8.02.00 Operating system of the HMI shall be 64-bit Windows Professional/Enterprise version and necessary application software such as relays configuration & setting software, Disturbance record analysis software, Relays IEC 61850 configuration software, Ethernet Switches configuration software, Anti-virus software, etc shall be installed in the HMI.
- 8.03.00 Licensed software for automatic downloading & saving of Disturbance records and Event records from Numerical relay to Switchgear Engineering works stations (EWS) shall also be provided & installed in HMI (Switchgear EWS).
- 8.04.00 Laptops shall have same hardware configuration and software as for HMI PC except screen size which shall be 14 inches.
- 8.05.00 HMI console (furniture i.e. Table with drawer & chair) shall be provided for each HMI. The console shall have space for keeping an additional PC (to be supplied as part of main plant & switchyard DC health monitoring system) also.

9.00.00 SYSTEM SOFTWARE REQUIREMENTS AND DOCUMENTATION

- 9.01.00 The Contractor shall provide all licensed software packages required by the system for meeting the intent, functional and parametric and performance requirements of the specification. All licenses (except anti-virus which shall be valid for 3 years) shall be valid for the continuous service life of the plant.

10.00.00 SYSTEM SECURITY

- 10.01.00 Security features shall be provided for Identification and authentication control at each level for safeguarding against unauthorized access.
- 10.02.00 The contractor shall provide software locks / passwords to the Employer's engineers at site for all operating and application software at all levels.
- 10.03.00 Security Audit for Switchgear Relay Network shall be done as mentioned in Section-VI, Part-B Sub-Section – IIIC-02 DDCMIS Annexure IIIC-02J. Suitable actions based on the findings of the security audit shall be carried out by the relay/ Ethernet switch supplier.

10.04.00 STANDARDS AND COMPLIANCE

- 1.02.00 The system shall comply with the latest versions of the following Standards and Specifications as a minimum:
- 10.04.01 IEEE 1686-2013: IEEE Standard for Intelligent Electronic Devices Cyber Security Capabilities.
- 10.04.02 IEC-62443-4-2: Security for industrial automation and control systems - Part 4-2: Technical security requirements for IACS components.
- 10.04.03 IEC TS 62351-6: Power systems management and associated information exchange - Data and communications security - Part 6: Security for IEC 61850.

11.00.00 FAST BUS TRANSFER SYSTEM

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- 11.01.01 The Fast Bus Transfer System (FBTS) shall be provided complete with panels and necessary wiring in order to meet the intended specification.
- 11.01.02 The Fast Bus Transfer System (FBTS) shall be microprocessor based which shall facilitate fast and safe transfer of supply from Unit to Station, Station to Unit and Between Unit Auxiliary transformers under Manual & Automatic modes. The FBTS shall have features to provide Fast, In-phase and Slow changeovers as per the system conditions. The priority of transfer attempts shall be in the above order.
- 11.01.03 FBT shall have IEC 61850 port to communicate with DDCMIS similar to other numerical relays.

12.00.00 ENGINEERING

- 12.01.00 Complete engineering including the following:
- (a) Development of Module Type-wise Schemes with hardwired & soft logics.
 - (b) Configuration of Feeder IED including Protection and Control logics
 - (c) Configuration of Fast Bus Transfer Systems
 - (d) Relay Network Design based on reliability & speed
 - (e) Configuration and application development of Switchgear relay network as required for real time monitoring & data acquisition
 - (f) Preparation & Submission of mimic document for Relay Network architecture for helping DDCMIS supplier to create the dynamic/static mimic in DDCMIS for Network monitoring
 - (g) Preparation of I/O lists for each module type for integration with DDCMIS on IEC-61850 protocol
 - (h) The integration of Switchgear Relay Network with Switchgear DDCMIS shall be finalized in consultation with the Switchgear DDCMIS supplier in Technical Co-ordination meetings (TCMs) and the same shall be tested as a part of Major Design Feature testing with a prototype system of the offered Switchgear relay Network system, at the works of the DDCMIS supplier or any other place approved by Employer.
 - (i) The required. ICD / .CID files of the Numerical relays under MV Switchgears for the integration with the DDCMIS shall be provided by the Numerical relay vendor along with necessary engineering support as and when required during detail engineering.
 - (j) During the Factory Acceptance Test (FAT) of the DDCMIS, Relay & Ethernet Switch supplier will arrange a prototype ring with at least three ethernet switches (L2) with one numerical relay of each type and L3 Switches network, at the works of the DDCMIS supplier along with the necessary engineering support. Exact test setup shall be finalized during detailed engineering.
- 12.02.00 Numerical relay configuration for all relays being supplied under the package shall be carried out in line with the approved schematics and shall be submitted for Employer's approval. Setting calculations and relay settings configured in relay software for all relays shall be submitted for Employer's approval. Approved relay configuration / settings files shall be loaded in all the relays prior to dispatch to site.

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13.00.00 TRAINING

13.01.00 The vendor shall arrange for training on system design, engineering, operation and maintenance of Numerical relays & Numerical relay Network system at the principal's facility and at site as follows:

13.02.00 Training at principals works (Relay Manufacturer) in the following areas:

- a) Basics of Feeder, Transformer and Motor Protection for IEC 61850 Numerical relay and detail discussion on functions available in the relays.
- b) Relay configurations and hands on practice of preparation of logic & settings, .CID files through relay software tools and relay GOOSE Logics.
- c) Interfacing / communication of relay with software: uploading / downloading of logic.
- d) Secondary injection testing of provided function blocks and guidelines for relay settings. DR downloading and analysis for Fault diagnostics
- e) Common problems faced and trouble shooting

The Scope shall include providing training in the areas stated above for five (5) No Executives from Engineering, Site Erection, and O & M for a duration of five (5) days. The cost of training including boarding & lodging and local transportation shall be in the vendor's scope. However, the total duration of the training for MV/LV switchgear including numerical relays shall be elaborated in Part-C section-IV of technical specifications.

13.03.00 Training Workshop at Site

Workshop Training at site shall aim for familiarization of Site Engineers for commissioning and day to day O & M of Numerical Relays and Numerical Relay Network and trouble shooting.

The scope shall include Two No's of Numerical Relay and Numerical Relay Network workshops and Training for a batch of 20 Engineers at Project Site. One such Workshop shall be organized before the commissioning of First MV Switchboard and the Second workshop shall be conducted before Unit Commissioning. Employer shall provide the required Infrastructure such as Training Conference room, Projection systems etc. However, the total duration of the training for MV/LV switchgear including numerical relays shall be elaborated in Part-C section-IV of technical specifications.

14.00.00 AUXILIARY POWER SUPPLY

14.01.00 The numerical relays & Ethernet switches being installed at switchboard shall be suitable for auxiliary power supply 240V DC/110V DC with tolerance of 80% to 120 % of rated voltage & shall be finalized during detailed engineering. Ethernet switches shall have provision to receive dual redundant power supplies. However, other network components such as Network level switches, HMI,etc. shall be suitable for 240V AC & redundant 240V AC UPS supply for these components shall be provided.

15.00.00 INPUT / OUTPUT INTERFACE, FILTERS AND OPTICAL ISOLATION

15.01.00 Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature.

15.02.00 All I/Os shall have optical isolation. Analog inputs shall be protected against switching surges, harmonics etc.

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15.03.00 No separate earth bus shall be required for the relays. It shall be possible to connect the relay earth to the common earth bus in the switchgear panel which shall be connected to the plant earth mat.

16.00.00 TIME SYNCHRONIZATION

16.01.00 Time clock synchronization equipment provided for the DDCMIS shall have SNTP port and all the clocks of the numerical relays, Ethernet Switches, HMI, etc., shall be time synchronized on SNTP with the same. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system. Necessary cable (with protective conduit, if required) for connecting the GPS receiver / clock to the Network level switches shall also be in bidder's scope.

16.02.00 One Digital display of time shall be provided in the Network level Ethernet switch box.

17.00.00 TYPE TESTS AND FACTORY ACCEPTANCE TESTS

17.01.00 Type test reports for the following tests on the model of the relays & Ethernet switches being offered shall be submitted for Employer's review. Type Tests of Ethernet Switches shall have been conducted at NABL accredited Lab.

S. No.	TEST ITEMS	Standard
1	Dimensions of structure and visual inspection	IEC 60297-3-101
2	Functional requirements: – Steady-state simulation – Dynamic simulation	Relevant IEC 60255-100 series
3	Product safety requirements (including the dielectric tests and thermal short time rating)	IEC 60255-27
4	EMC requirements: – Emission – Immunity	IEC 60255-26
5	Energizing quantities: – Burden – Change of auxiliary energizing quantity	N/A IEC 60255-11
6	Contact performance	N/A
7	Communication requirements	Relevant IEC protocol standards

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8	Climatic environmental requirements:	IEC 60068-2-14,
	– Cold	IEC 60068-2-1,
	– Dry heat	IEC 60068-2-2,
	– Change of temperature	IEC 60068-2-78,
	– Damp heat	IEC 60068-2-30, IEC 60255-27
9	Mechanical requirements: – Shock	IEC 60255-21-1,
	– Vibration	IEC 60255-21-2,
	– Bump	IEC 60255-21-3
	– Seismic	
10	Enclosure protection	IEC 60529, IEC 60255-27

18.00.00 ERECTION AND COMMISSIONING AND SAT FOR NUMERICAL RELAYS & RELAY NETWORK SYSTEMS

18.01.00 The contractor shall prepare an erection guideline and commissioning Procedure, SAT procedure for the Relay Network system and submit to Employer for review and approvals.

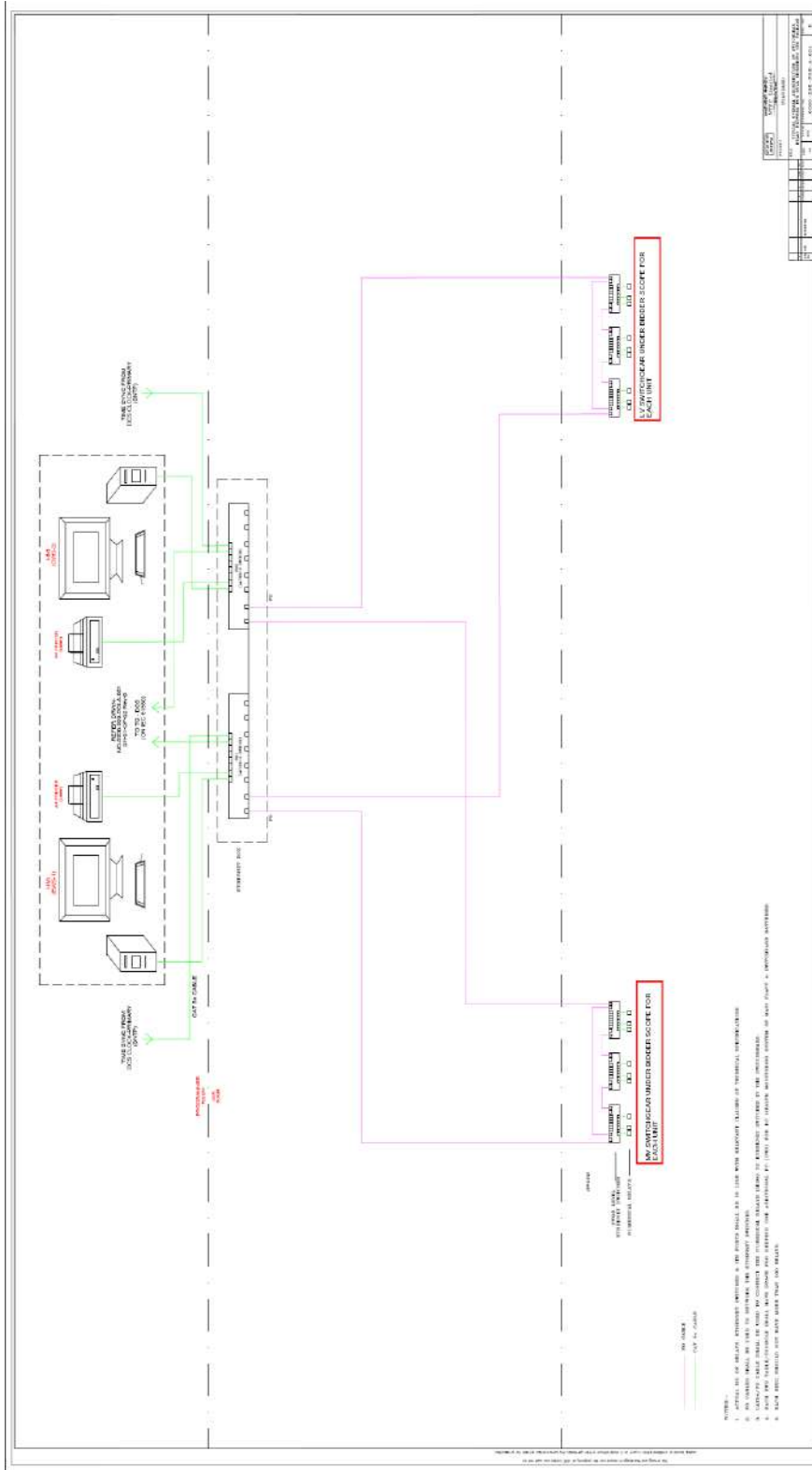
19.00.00 RELAY TEST EQUIPMENT

19.01.00 The required relay test equipment shall comprise the following:

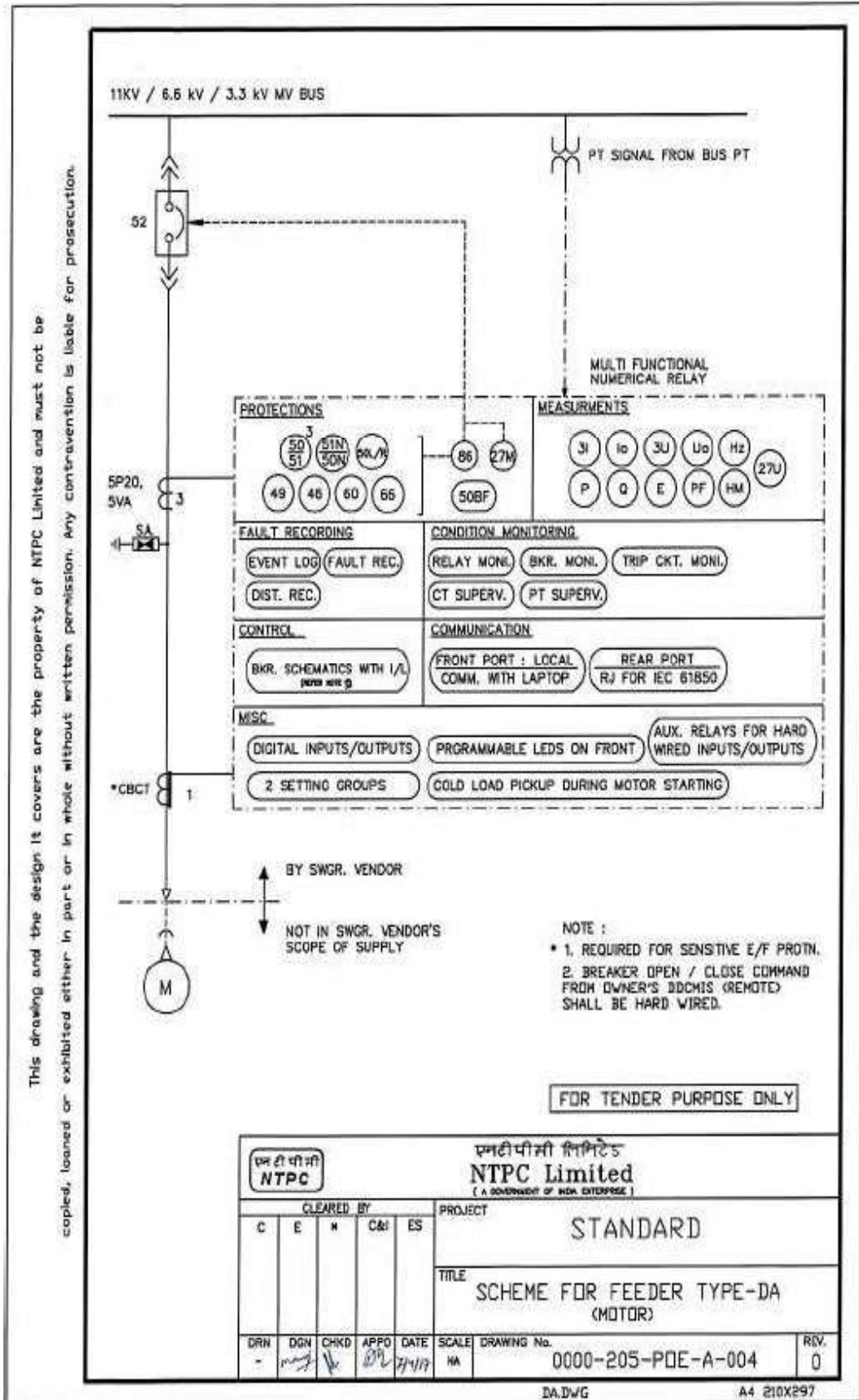
- (a) One 3 phase (4 Voltage and 6 current sources) dynamic portable relay test system for allowing dynamic and steady state testing.
- (b) Any other auxiliary items required for comprehensive protection testing all types of the protection relays supplied under this contract.

19.02.00 It shall have the capability to replay the Disturbance / Fault records acquired by the numerical relays in IEEE / COMTRADE format or EMTP simulations, to facilitate dynamic testing of all the numerical relays supplied under this contract. The required software for steady state/dynamic testing of all the numerical protection relays along with a laptop dedicated for the testing shall also be supplied. The relay test set shall be suitable for IEC 61850 compliance testing with required no. of RJ45, FO and USB Ports. The test set shall have min 8 nos. (GI) binary inputs and 4 nos. (GI) binary outputs. The associated software for automated relay testing and IEC61850 GOOSE/GSSE Configuration shall also be supplied.

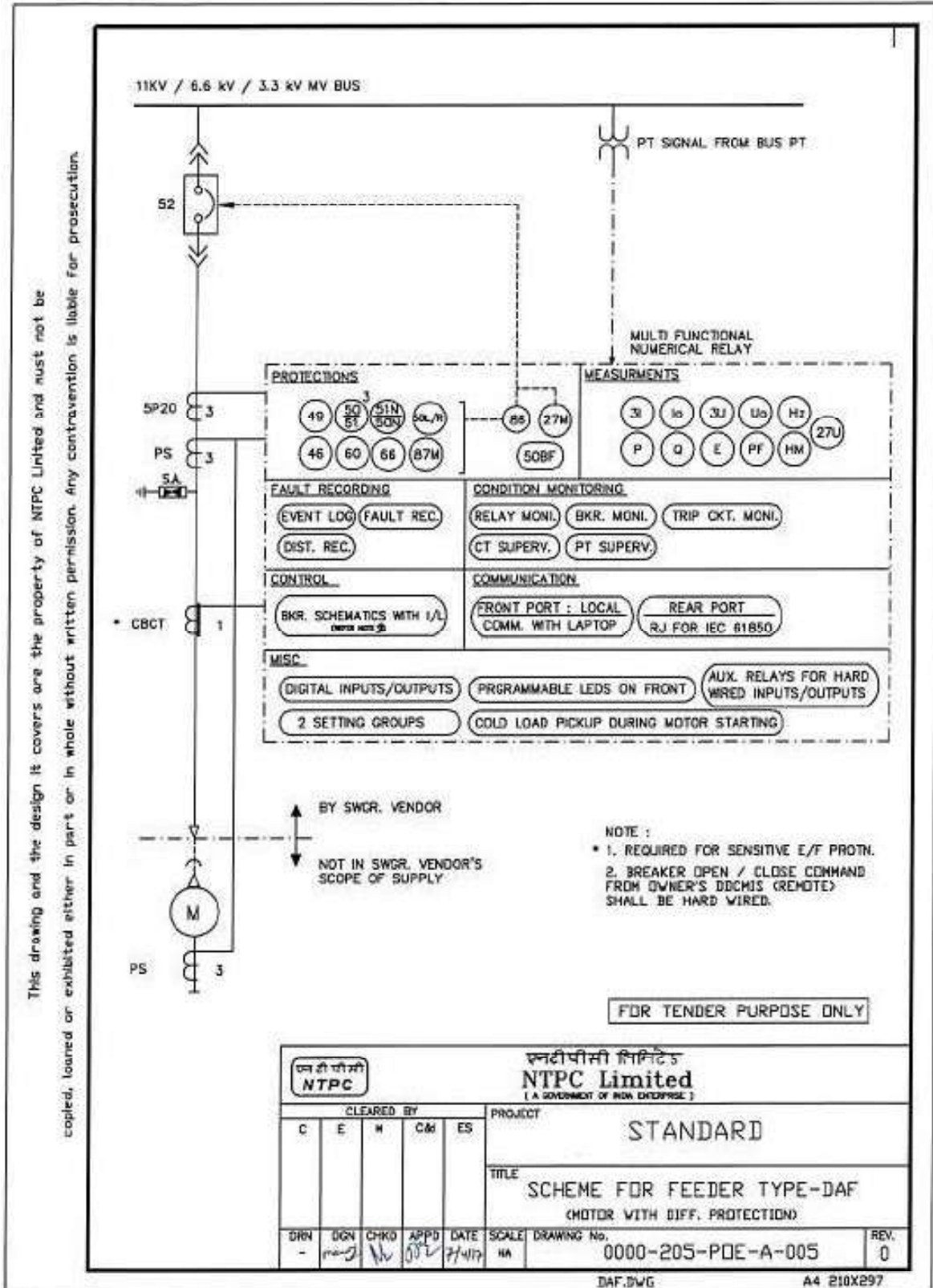
TECHNICAL REQUIREMENTS



TECHNICAL REQUIREMENTS

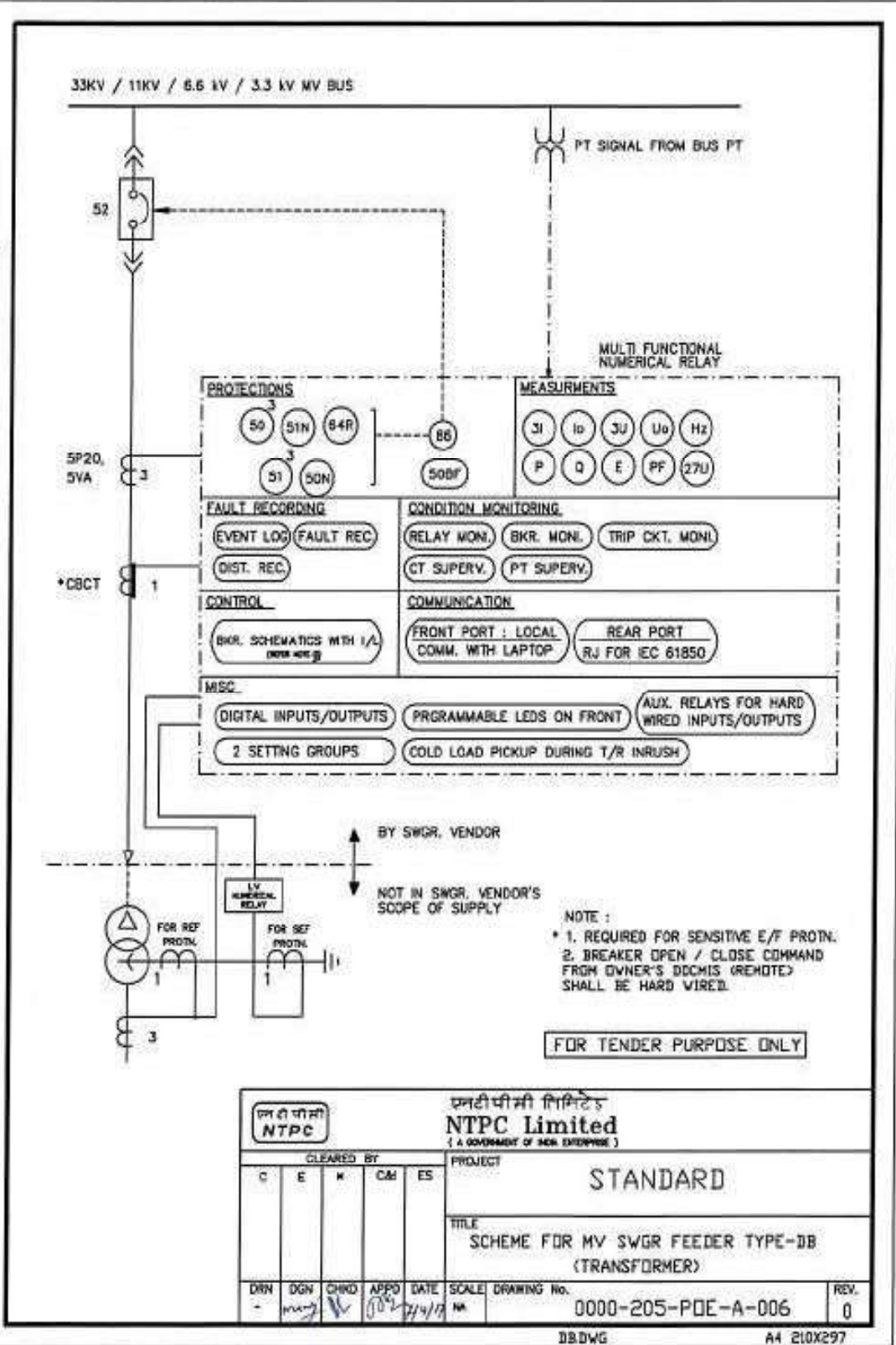


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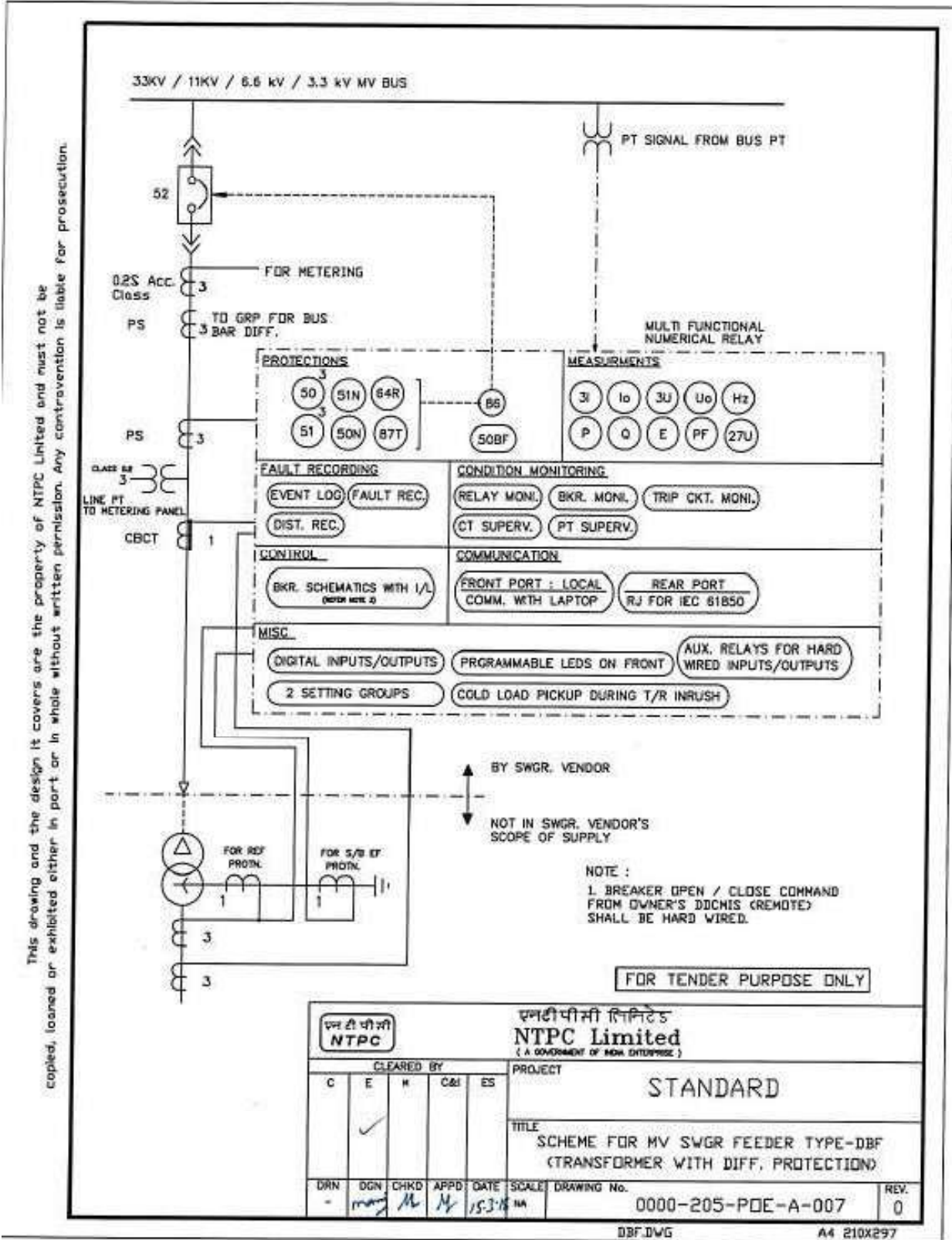


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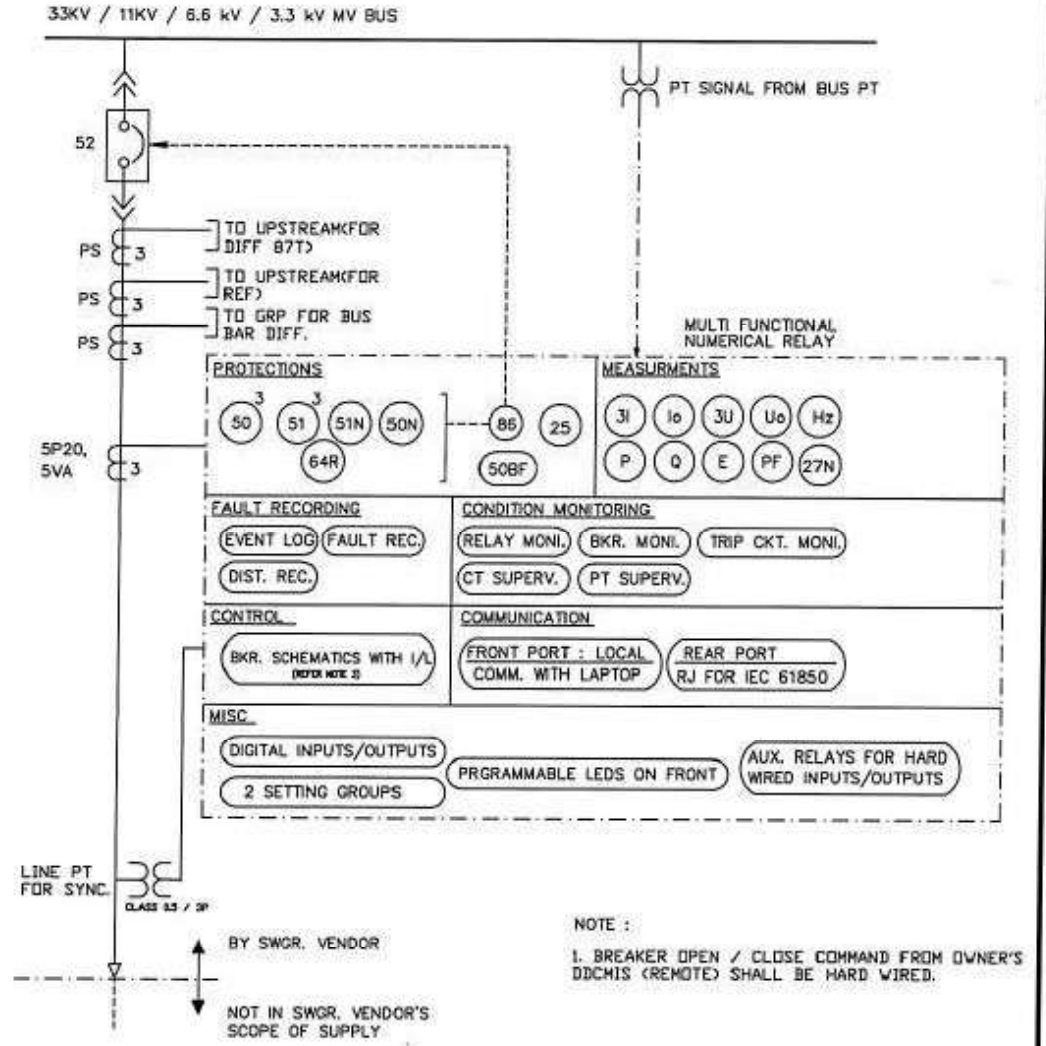


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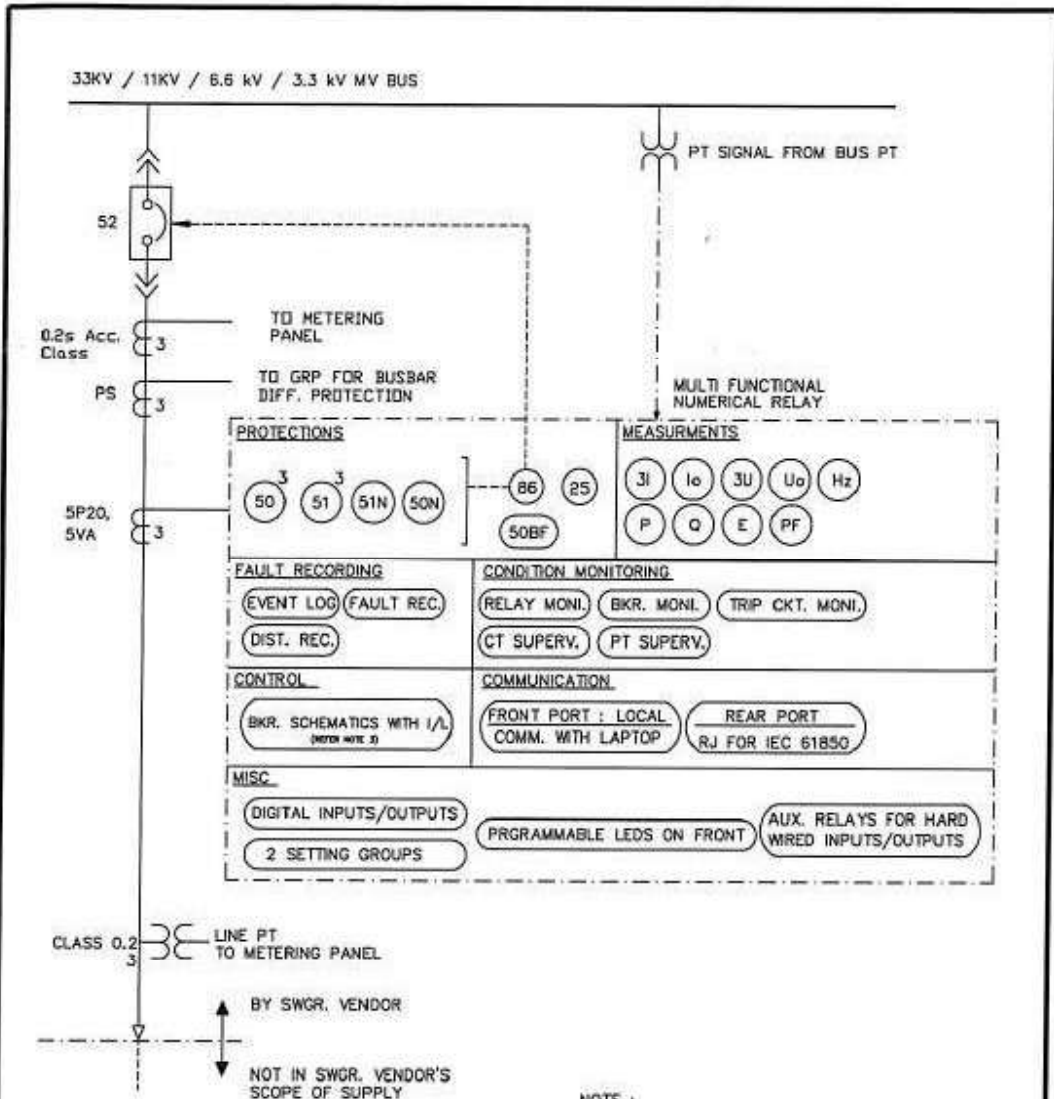
NOTE :
1. BREAKER OPEN / CLOSE COMMAND FROM OWNER'S DDCMIS (REMOTE) SHALL BE HARD WIRED.

FOR TENDER PURPOSE ONLY

एनटीपीसी लिमिटेड NTPC Limited <small>(A GOVERNMENT OF INDIA ENTERPRISE)</small>												
PROJECT STANDARD												
TITLE SCHEME FOR MV SWGR FEEDER TYPE-DC (INCOMER)												
C	E	H	C&I	ES								
-	✓				DRN	DGN	CHKD	APPD	DATE	SCALE	DRAWING No.	REV.
				15.3.18	NA	0000-205-P0E-A-008				0		

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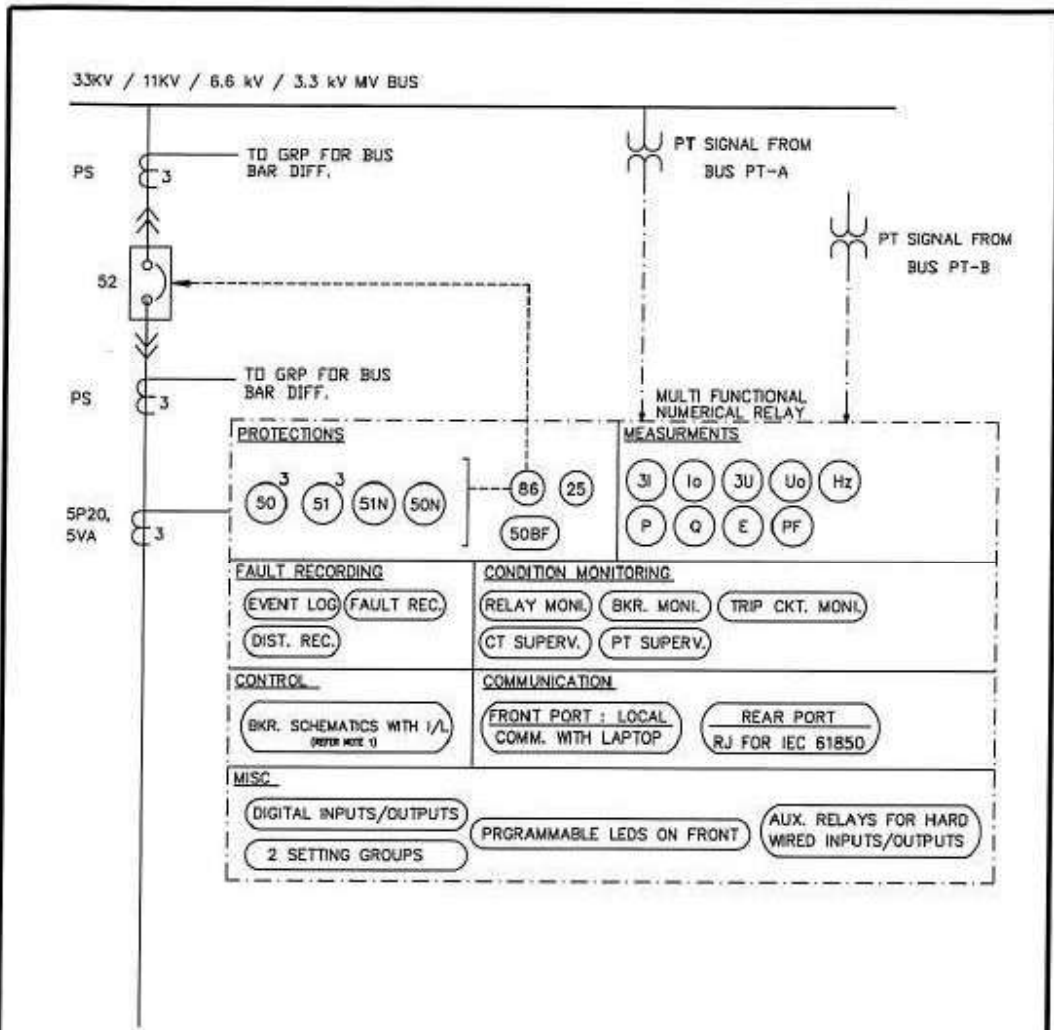
NOTE :
1. BREAKER OPEN / CLOSE COMMAND FROM OWNER'S DDCHIS (REMOTE) SHALL BE HARD WIRED.

FOR TENDER PURPOSE ONLY

		एनटीपीसी लिमिटेड NTPC Limited <small>(A GOVERNMENT OF INDIA ENTERPRISE)</small>	
PROJECT: STANDARD			
TITLE: SCHEME FOR MV SWGR FEEDER TYPE-DE (TIE FEEDER)			
CLEARED BY:		DATE: 15-3-18	
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DRAWING No.		REV.	
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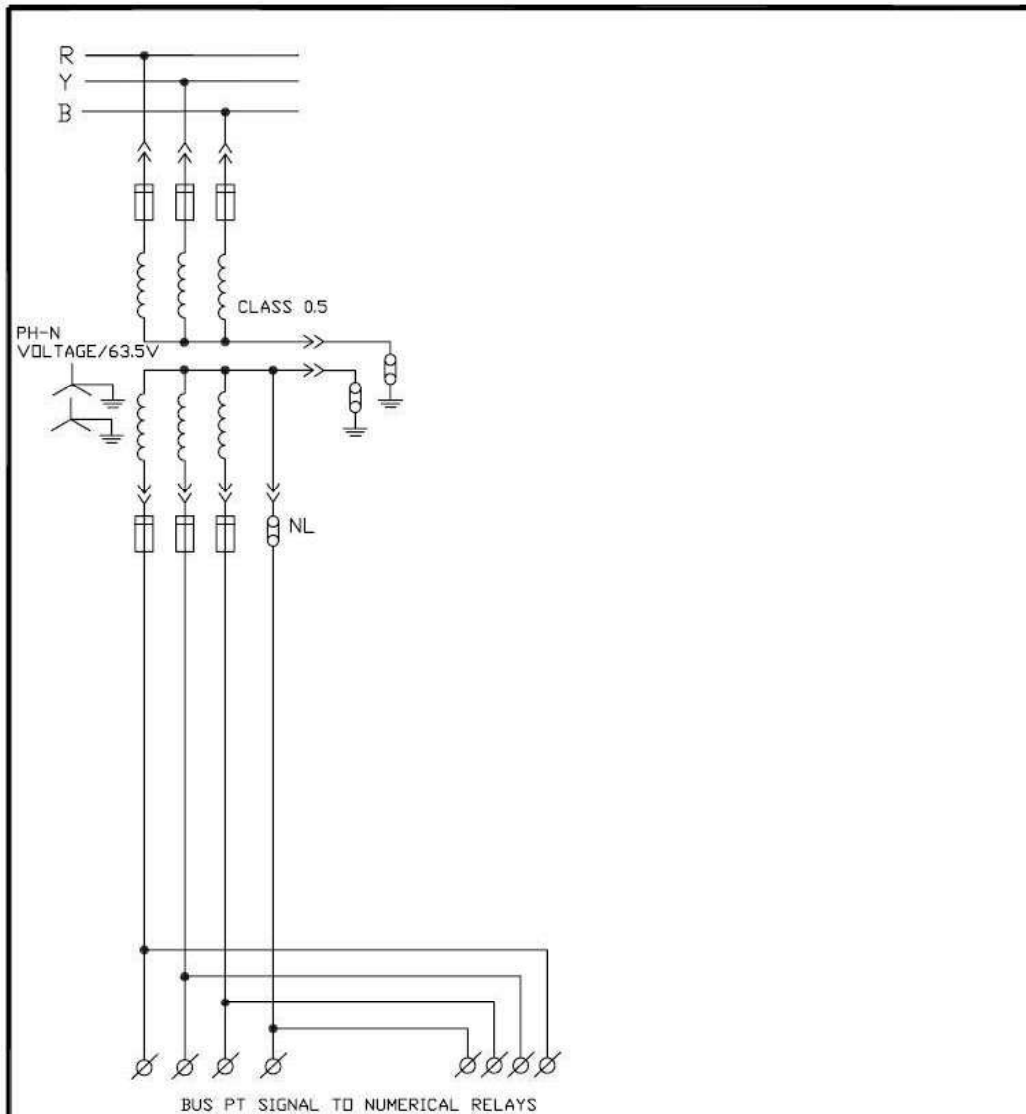
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TECHNICAL REQUIREMENTS

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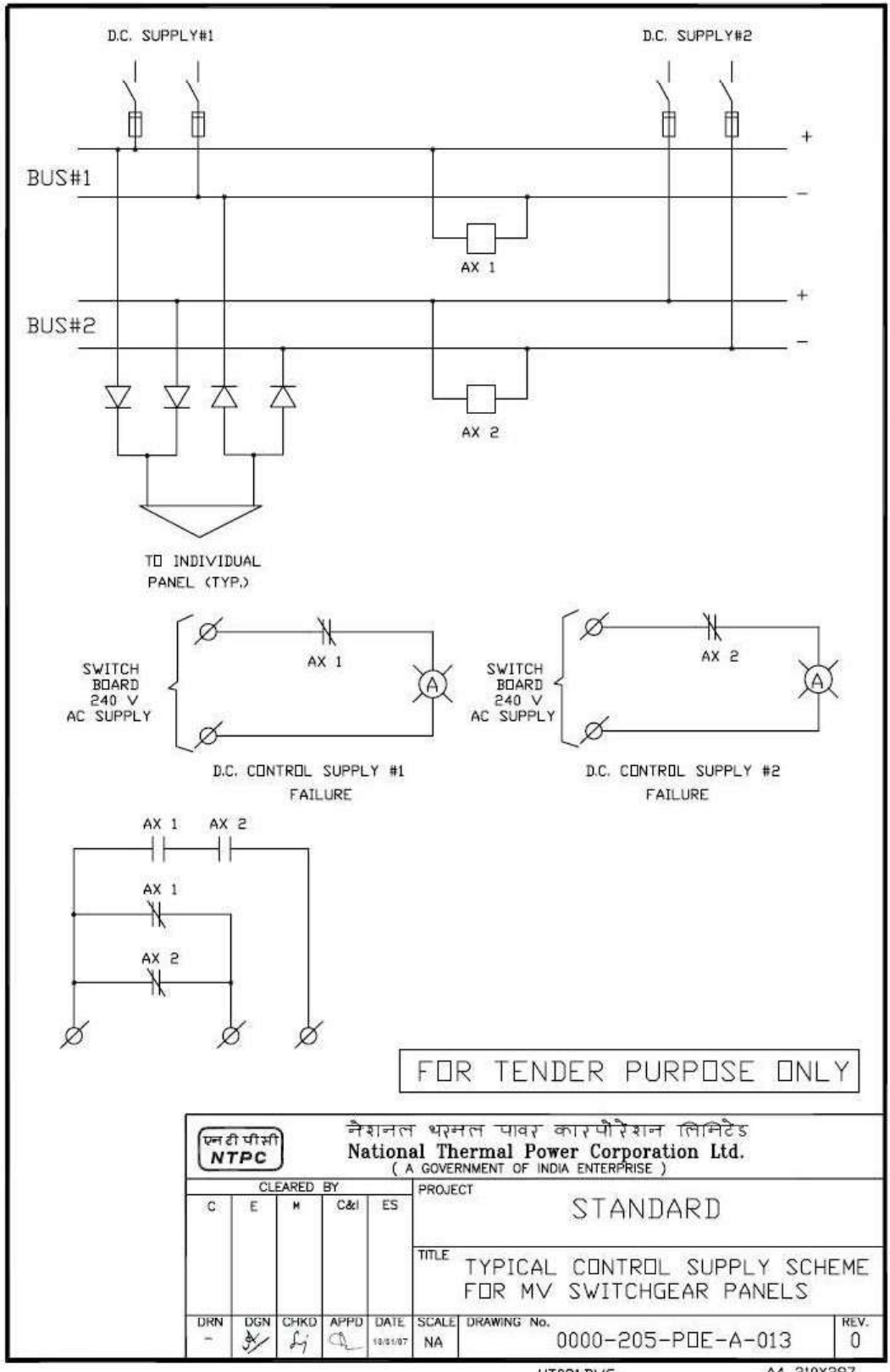
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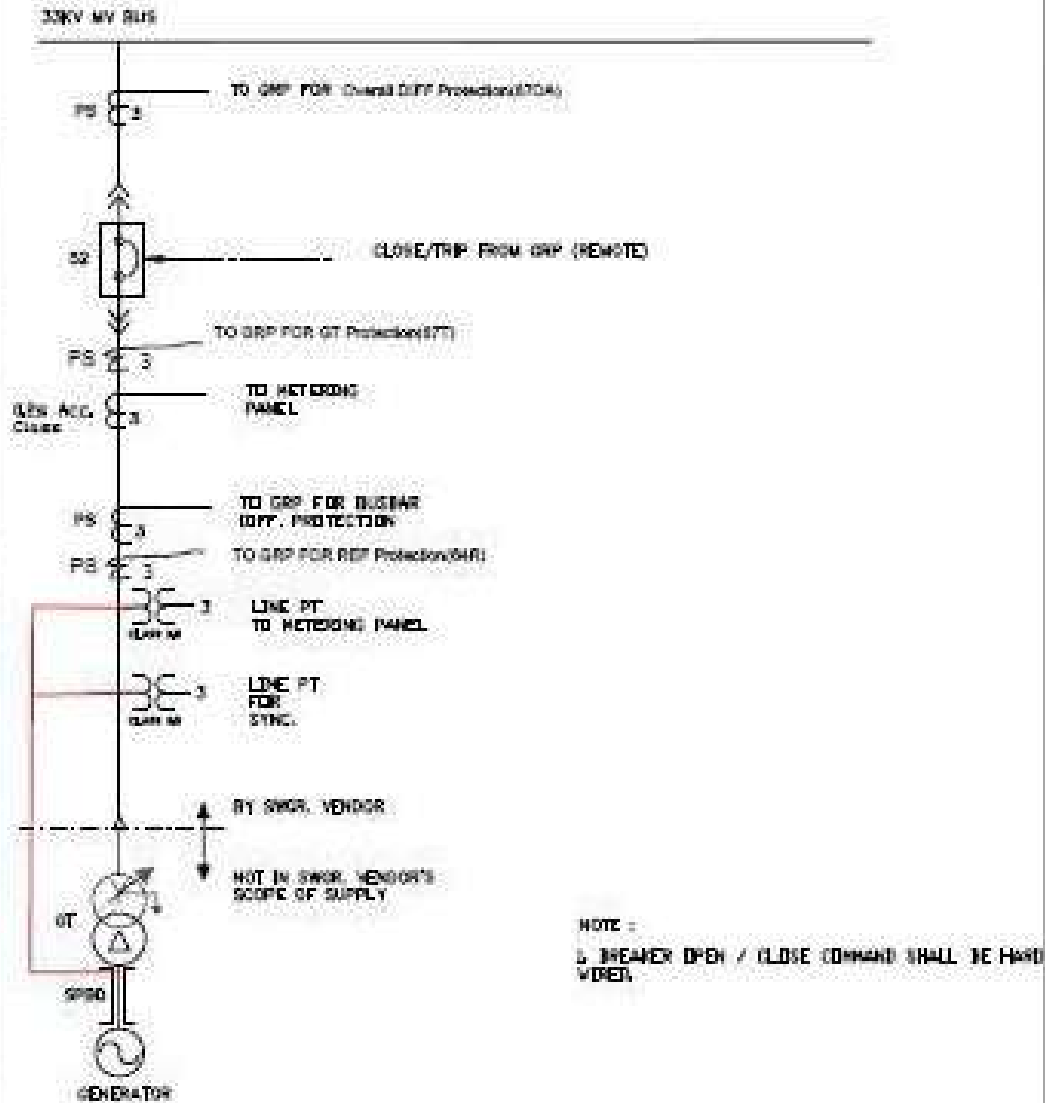
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PART-B
VOLUME – II
CHAPTER – II-E10
LT SWITCHGEAR & LT BUSDUCT

TECHNICAL REQUIREMENTS

1.00.00

CODES AND STANDARDS

IS: 5	Colours for ready-mixed paints and enamels.
IS: 694	PVC insulated cables for working voltages up to and including 1100V.
IS: 722	A.C. Electricity Meters
IS: 1248	Electrical Indicating instruments
IS/IEC: 60947-1	Degree of protection provided by enclosures for low voltage Switchgear and Control gear
IS/IEC: 60947-2	A.C. circuit Breakers, MCCB, MCB, MPCB
IS: 2551	Danger Notice Plates
IS: 2629	Hot dip galvanising
IS: 2705	Current Transformers
IS/IEC: 60947-4-1	Contactors and motors starter for voltages not exceeding 1000 V AC or 1200 V DC
IS: 3043	Code of practice for earthing.
IS: 3072	Code of practice for installation and maintenance of Switchgear
IS: 3156	Voltage Transformers
IS: 3202	Code of practice for climate proofing of electrical equipment.
IS: 3231	Electrical relays for power system protection.
IS/IEC 60947	Air-Break Switches, air break disconnectors, air break disconnector and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC.
IS/IEC 60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.
IS: 5082	Wrought Aluminium and Aluminium alloys for electrical purposes.
IS: 6005	Code of practice of phosphating of iron and steel.
IS/IEC 60947-5-1	LV switchgear and Control gear Control current devices and switching element.
IS: 8623 / IEC: 61439-1/2	Low Voltage Switchgear & Control gear assemblies

TECHNICAL REQUIREMENTS

IS: 8686	Static Relays
IS: 13703 / 60269	IEC: HRC Cartridge fuses
IS: 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.
IS: 11171	Specification for dry type transformers.
IEC: 60255	Electrical Relays
IEC: 61850	Communication networks and systems in substations
IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals
IS: 12021	Specification of control transformers for switchgear and Control gear for voltage not exceeding 1000V AC.
IEC: 60947-7-1	Terminal blocks for Copper conductors
IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips

2.00.00 TECHNICAL PARAMETERS

2.01.00 Power Supply

2.01.01 AC SYSTEM

1)	Voltage	415 V \pm 10%,3 Phase, 4 wire, solidly earthed
2)	Frequency	50 Hz +/- 5%
3)	Combined variation (in volts & frequency)	10% absolute sum
4)	Fault Level	50 kA(RMS)

2.01.02 DC SYSTEM

1)	System Voltage	220 V DC 2-Wire, Unearthed
2)	Fault Level	20 kA

2.01.03 CONTROL SUPPLY VOLTAGE

1)	(i) Closing coil of circuit breaker	220 V DC/110 V DC
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TECHNICAL REQUIREMENTS

2)	Spring charging motor	220 V DC/110 V DC
3)	MCC control supply	110 V AC Neutral solidly earthed
4)	Space heater & lighting	240 V AC Neutral solidly earthed

2.02.00

CUBICLE DATA

2.03.00

Busbar Rating

1)	Continuous Current rating	As per requirement /Sizing Calculation
2)	Short time rating where	
	a) CB is used as incomer	50 kA(RMS) for one sec (Ph-Ph & Ph-N)
	b)MCCB is used as incomer	Prospective current of 50 kA(RMS) for the MCCB clearing time , (Ph-Ph & Ph-N)
3)	Dynamic Rating where	
	a) CB is used as incomer	105 kA(PEAK) , (Ph-Ph & Ph-N)
	b)MCCB is used as incomer	Prospective current of 105 kA (PEAK) as limited by MCCB (Ph-Ph & Ph-N)
4)	Busbar insulation	
	a) For switchgear /MCC/ACDB/DCDB /MCCB Box	PVC Sleeve insulated(UL224) CE/UL certified
5)	Horizontal Busbar & Jumper Connection	High Conductivity Aluminium Alloy/Copper
6)	Vertical Busbar	Copper Only
7)	Hardware for busbars(Bolts/Nuts/Spring Washer)	High Tensile steels

2.04.00

Enclosure Details

TECHNICAL REQUIREMENTS

1)	Material	CRCA 2mm: Load bearing Structure and Frame 1.6mm: Doors, covers etc 3mm for Gland Plates (CRCA/HR) 4mm for Gland plates (Non-Magnetic) –Single Core Cable Entry
2)	Type	Metal enclosed, indoor, floor-mounted, Free Standing Type
3)	Degree of Protection	IP:52 (below 1600 Amp.) (IP:42 for Busbar chamber, 1600 Amp & above, Gasketing arrangement shall be as per type tested design for IP 5X) As per IS/IEC:60947 IP65: Paddle Feeder and Travelling Tripper MCC IP55: Outdoor Panels enclosed in Stainless Steel Mounted on 500 mm Pedestal
4)	Design	Complete Closed Door Design
5)	Internal Arc Classification	50KA, 0.5 sec
6)	Cable Alley Compartment	Form-4B as per IEC-61439
7)	Gasket	Steel Reinforced EPDM /PU Foam/Neoprene gaskets
8)	Height	2450mm max
9)	Clearances	i) 25 mm: (Ph-Ph)/(Ph-earth) for Horizontal/vertical busbars and circuit breaker chamber. ii) Inside the modules: Min 25mm. However, if clearances are $\geq 10\text{mm}$ and $< 25\text{mm}$ shrouds/insulation barrier may be provided. Physical clearance less than 10mm shall not be allowed in any of the cases between Ph-Ph or Ph-E. iii) Incomer Rear Door and Busbar-400mm

2.05.00

CIRCUIT BREAKER

1)	Type	Air break spring charged stored energy type
2)	Operating duty	O-3 min-CO-3 min-CO

TECHNICAL REQUIREMENTS

3)	Symmetrical interrupting	50 kA(RMS)
4)	Short circuit rating	105 kA(PEAK)
5)	Short Circuit Breaking current	
	a) AC Component	50 kA(RMS)
	b) DC Component	As per IS/IEC 60947
6)	Short time withstand	50 kA(RMS) for 1 s
7)	No of aux. contacts	4 NO + 4 NC for DDCMIS interface 6NO+6NC Auxillary Contact(directly operated from breaker operated Mechanism)
8)	Antipumping Feature	Both Mechanical and Electrical

2.06.00

METERS

1)	Accuracy Class	2.0
2)	One min. power frequency withstand test voltage	2.0 kV(RMS)

2.07.00

Current Transformers

1)	Type	Cast Resin Bar Primary / Nylon Casing
2)	Voltage class and frequency	650 V, 50 HZ
3)	Class of insulation	E or better
4)	Rated Secondary Current	1 A
5)	Accuracy class & burden	
	a) For protection	5P20, 5VA PS Class for REF
	b) For metering	class 1.0, 5VA (min) class 0.2s, 5VA (min) for feeders indicated in SLD ,if any
6)	Instrument Security Factor (ISF) for metering CT	5

TECHNICAL REQUIREMENTS

7)	Short time withstand	
	a) For CT Associated with circuit breaker	50 kA(RMS) for 1 sec
	b) For CT Associated with MCCB protected feeders	Prospective current of 50 kA(RMS) for the MCCB clearing time
8)	Dynamic withstand	
	a) For CTs Associated with circuit breaker	105 kA(PEAK)
	b) For CT Associated with MCCB protected feeders	Prospective current of 105 kA(PEAK) as Limited by MCCB

2.08.00

BUSDUCT (NON-SEGREGATED, AIR INSULATED TYPE)

1)	Rating	As per requirement /Sizing Calculation
1)	Type	Non-Segregated
2)	One minute power frequency withstand voltage	2.5 kV
3)	One second short ckt withstand current	50 kA(RMS)
4)	Momentary dynamic current withstand	105 kA(PEAK)
5)	Enclosure	3mm Al Alloy Rectangular(IP:55) Al sheet flange protection hood for outdoor
8)	Gasket	Steel Reinforced EPDM /PU Foam /Neoprene gaskets
9)	Conductor	Material: Alumunium Clearance:25 mm(Min)
10)	Steel Structure	Hot Dipped Galvanised
11)	Earthing	GI of Adequate Size along full length

TECHNICAL REQUIREMENTS

2.09.00

BUSDUCT (SANDWICH TYPE)

1)	Type	Bus Trunking
2)	Rated Insulation voltage	1000V
3)	One second short ckt withstand current	50KA(RMS)
4)	Momentary dynamic current withstand	105KA(PEAK)
5)	Power frequency withstand voltage	3.5kv
6)	Impulse withstand voltage	8kV
7)	Insulation	Class F
8)	Conductor	Material: AL/Cu
9)	Enclosure	CRCA/GI:1.6mm Al:2.5mm DOP:-IP:55
10)	Gasket	Steel Reinforced EPDM /PU Foam/Neoprene gaskets
11)	Earthing	GI of Adequate Size along full length
Bidder to provide adequate interposing busduct arrangement or any other adequate measure to balance the capacitive voltage between three phases while connected with DG set at switchgear end.		

2.10.00

VOLTAGE TRANSFORMERS

1)	Type	Cast Resin
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TECHNICAL REQUIREMENTS

2)	Voltage Ratio	415 / 110 V for line PT 415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V for Bus PT
3)	Method of Construction	V-V
4)	Accuracy Class	0.5 0.2 for feeders indicated in SLD ,if any
5)	Rated Voltage factor	1.1continuous, 1.5 for 30 sec.
6)	Class of insulation	E or better
7)	One minute power frequency withstand voltage	2.5 KV

2.11.00

HRC FUSES

1)	Voltage Class	650 Volts
2)	Rupturing capacity	80 kA (rms) for AC ckt., 20 kA for DC ckt.

2.12.00

CONTACTORS

1)	Type	Air break electro magnetic
2)	Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives DC3 for DC contactor
3)	Operating Coil Voltage	(i)110V AC(-15%--+10%) Drop out voltage-less than 70% Guaranteed Drop out at 20% of rated voltage (ii)220V DC((-15%--+10%)

2.13.00

Relays

1)	Power frequency withstand voltage	2.5 kV for 1 sec. or 2.0 kV for 1 min.
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TECHNICAL REQUIREMENTS

2.14.00

CONTROL TRANSFORMERS

1)	Type	Dry / Cast Resin
2)	Voltage Ratio	415 / 110 V with taps $\pm 5\%$ in steps of 2.5%
3)	Class of insulation	Class-B or better
4)	One minute power frequency withstand voltage	2.5 kV
5)	Rating	1.5 X Adequate for application.

2.15.00

LIGHTING TRANSFORMER / WELDING TRANSFORMER

1)	Type & Rating	Dry type / 100 KVA(Welding TRF), 50KVA(Minimum)(Lighting TRF)
2)	Voltage Ratio	415/415V, +/- 5% taps in steps of 2.5%
3)	Class of insulation	B or better
4)	One minute power frequency	2.5 KV
5)	Enclosure protection	IP-42
6)	Type Test	As per IS 2026
7)	Fault level	3-5 KA secondary side

2.16.00

TRANSDUCERS

1)	Current transducers	
	a) Input	0-1 A (CT secondary)
	b) Rated frequency	50 Hz
	c) Output	4-20 mA (2 Nos. decoupled)
	d) Over current	Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds

TECHNICAL REQUIREMENTS

	e) Accuracy	1.0
2)	Voltage Transducers	
	a) Input	500 V, 50 Hz (for AC) / 250 V / 125 V DC (for DC)
	b) Output	4-20 mA (2 Nos. decoupled)
	c) Accuracy	1.0

2.17.00

MCCB & MPCB

1)	Type	Thermal Magnetic based(in built front adjustable releases
2)	Rated insulation level	690V
3)	Rated ultimate & Service S.C. breaking capacity	50 kA
4)	Rated making capacity	105 kA
5)	Utilization category	A

2.18.00

NOT USED

2.19.00

MCB

1)	Rated voltage	415V/240V/110V AC 240V DC
2)	Current breaking Capacity	10 KA
3)	Characteristic Curve	C or above

2.20.00

AC & DC MCCB Box

1)	Construction	(i)Metal Enclosed Fixed Type CRCA:2mm structure :1.6mm enclosure Or (ii)Poly Carbonate (a) Halogen Free,flame Retardant(UL-94,V0) (b) Thickness:4mm (iii) UL224 sleeved Busbars
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TECHNICAL REQUIREMENTS

2)	Degree Protection	of	Indoor: IP52 Outdoor: IP54
3)	Characteristic Curve		C or above

2.21.00

Earth Bus and Earthing

Material	GS/Cu/Al of Sufficient cross section Separate Copper Earth bus for Electronic Earthing
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2.22.00

Internal Wiring and Control Terminal Blocks

Control Terminal Blocks		
1)	Rating	650V grade , 10 A ,6.6 polyamide
2)	Type	Screw less, push in technology(IEC 60947-7-1 and UL certified)
3)	Spare	20%
Internal Wiring		
1)	Rating	650 V grade, FRLS, single core 2.5 sq. mm cu for CT connection 1.5 sq. mm cu for others

3.00.00

CONSTRUCTIONAL DETAILS OF SWITCHBOARDS

3.01.00

All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:

(a.) BUSBAR COMPARTMENT

A completely enclosed bus bar compartment shall be provided for the horizontal and vertical bus bars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power bus bars shall be in separate compartments All moving and fixed contacts of each draw-out modules must be of rating more than 125% of MCCB/MPCB mounted inside the module. Each phase of vertical busbars shall be separated by phase barrier and same shall be sleeved (UL-224).

SWITCHGEAR / FEEDER COMPARTMENT

All equipment associated with an incomer or outgoing feeder shall be housed in a separate compartment of the vertical section. Two-tier breaker arrangement in a vertical section shall be offered for outgoing breaker feeders of rating up to 1600A. Fixed part of vertical busbar and moving part of draw-out modules for power connection shall be of Silver/Tinned plated Copper only. No live parts shall be accessible with equipment drawn out. The Module compartment door shall have external padlocking facility with MCC frame/fixed structure.

TECHNICAL REQUIREMENTS

A separate compartment shall be provided for relays and other control devices associated with a circuit breaker. For breaker-controlled motor feeders, an aux. relay shall be provided for taking Local push button station (EPB) "normally open (NO)" contact input from field and provide potential free output to DDCMIS to avoid probable mixing of switchgear control voltage with DDCMIS 24V DC voltage. This aux. relay shall have 2NO+2NC contacts. Canopy shall be provided over EPB.

- 3.02.00 Wherever two breaker compartments are provided in the same vertical section, form 4B separation and separate vertical busbar chamber shall be provided. For Incomer panel suitable interlock shall be provided to prevent opening of rear cover, in case incoming supply is ON/Line is live and for Bus-coupler panel suitable interlock shall be provided to prevent opening of rear cover, in case either of the bus-section is in charged condition.
- 3.03.00 All 415V air circuit breaker switchgear panels shall be of single-front type. MCCs and DBs shall be of single-front / double-front construction as per the requirements. All ACDBs, DCDBs and Solenoid Valve DBs shall be of fixed module type. MCCs located on the Stacker reclaimer, Paddle Feeders, Travelling Trippers shall be fixed type, single front.
- 3.04.00 For modules of size more than 300 mm, symmetric guides not less than 4 nos shall be provided for smooth removal or insertion of module. All identical module chassis of same size shall be fully interchangeable without having to carry out any modifications. Suitable interlock shall be provided in DCDB for prevention of opening of Isolator (Incomer) when the bus coupler is open and vice-versa.
- 3.05.00 All draw-out modules shall be provided with "Closed door operation" feature wherein movement of the module from "Isolated" position to "Test" position and to "Service" position & vice-versa and power ON / OFF operation of the module shall be possible only with the module door closed condition. Degree of protection of the panel shall be maintained in both "Service", "Test" and "Isolated" positions. Module door shall open only when module is in "Isolated" position and "Power off" condition. Interlock shall be provided to prevent the change of module state from "Isolated" to "Test" position and to "Service" position or vice-versa, if Main Switch/MCCB/MPCB of the module is kept in ON condition. All the modules shall be of standard width only and no half width, quarter width etc sized modules shall be acceptable.
It shall be possible to pad lock the module door irrespective of state of module i.e. "Service", "Test" or "Isolated". Module Operated Automatic safety shutter shall be provided to cover all the live power terminals in case the module is taken out from the panel.
- 3.06.00 2 nos of Dummy modules of each size to fill in module being taken out for maintenance purpose shall be provided in each switchgear room in case module door is part of module. These Dummy Modules shall be fitted in switchboard as vacant modules having no cut out on back side and cable alley side. In case door is hinged to the panel, 2 nos of blanking plates of each size need to be provided.
- 3.07.00 Minimum 10mm of gap shall be ensured between busbar and moving power contact tips while module is in "Test" position to ensure user safety.
- 3.08.00 Interlock mechanism shall be provided with the voltage monitoring such that, it should not be possible to open the rear door of incomer and bus coupler modules when the incoming power source is in live condition. In case of any bypass/overriding of this interlock appropriate hooter at local and alarm to DCS shall be provided by the bidder.

TECHNICAL REQUIREMENTS

- 3.09.00 Air Circuit Breakers Modules shall be provided with “Closed door operation” feature wherein movement of the module from “Isolated” position to “Test” Position and then to “Service” position & vice-versa and power ON / OFF operation of the module shall be possible only with the module door closed condition. Degree of protection of the panel shall be maintained in both “Test” and “Service” positions. Module door shall open only when module is in “Isolated” position and “Power off” condition.
- 3.10.00 Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn.
- 3.11.00 The compartment door of fixed type modules shall be interlocked to prevent opening while the MCCB/MPCB in “ON” condition.
- 3.12.00 Employer reserves the right to alter the cable entries, if required during detailed engineering, without any additional commercial implication.
- 3.13.00 The Contractor shall provide adopter panel / dummy panel required to meet various configuration / arrangement of busbars/layout requirement adopted by the Contractor. The Switchboards fed from indoor transformer will be flange connected to the same and the same shall be located as close as desirable to the transformer.
- 3.14.00 Wireless temperature monitoring system to be provided and same shall be integrated to DDCMIS/ separate HMI. Temperature sensors shall be installed in all relevant joints, contact joints etc. as per the standard OEM Practice, however Position of such sensors shall be decided at the time of detailed engineering. This shall be provided for the following switchgears:
- 3.15.00** All insulating components being used in panel shall be Flame Retardant as per UL-94 V0 flammability standard.
- 3.16.00 The switchboards shall comply with IS1893-Part-1 of min Zone V spectrum. ISMC of min 100mm to be provided in each board.
- 3.17.00 All electrical connections, busbar joints shall be with Zinc passivated or cadmium plated, high tensile strength MS bolts plated, high tensile strength MS bolts graded 8.8, nuts, and washer shall be used for all joints and supports for all the boards.

4.00.00 PROTOTYPE PANELS

To establish the compliance with the requirements of this technical specification, prototype panels shall be made and offered for the Employer’s inspection and approval before the start of bulk manufacturing of panels for this project. The exact configuration of such prototype panels shall be finalized during detailed engineering. The switchgear shall be modified complying the observation marked during Prototype inspection (if any)

5.00.00 CONSTRUCTIONAL DETAILS OF AC & DC MCCB BOX

- 5.01.00 Each DC MCCB Box shall comprise of the following :

TECHNICAL REQUIREMENTS

- (a.) 1 no. 63 A DP MCCB as incomer
- (b.) 100 A fully insulated (PVC sleeved, UL224) busbars.
- (c.) 8 nos. 16A outgoing DP MCCB feeders.
- (d.) 1 no. auxiliary contactor for supply monitoring.
- (e.) 1 no. Blue LED indicating lamp-

5.02.00 Each AC MCCB Box shall comprise of the following :

- (a.) 1 no. 63A TPN MCCB as incomer.
- (b.) 100 A, 3-phase, 4-wire, fully insulated (PVC sleeved, UL224) busbars.
- (c.) 9 nos. 16 A DP MCCB and 3 nos. 16 A TPN MCCB units as outgoing feeders.
- (d.) 3 nos. LED indicating lamps (R, Y, B) for incoming supply monitoring.

6.00.00 POWER BUSBARS AND INSULATORS

6.01.00 Two separate sets of vertical busbars shall be provided in each panel of double front MCCs / DBs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A.

7.00.00 NUMERICAL RELAYS & NETWORKING

Please refer Protection, Control and Monitoring chapter of MV & LV Switchgear.

8.00.00 Power Cable Termination

8.01.00 Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded Aluminium conductor, PVC/ XLPE insulated, armored / unarmoured and PVC sheathed cables. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc. for cables shall be provided by the contractor to suit the final cable sizes.

9.00.00 BUS TRUNKING SYSTEM (SANDWICH TYPE BUSDUCT)

9.01.00 Three phase Bus trunking system conforming to IEC 61439-6 / IS 8623 (Parts 1 & 2) shall be provided for connecting the Main and Standby DG sets to Unit Emergency Switchgears.

9.02.00 Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and DG terminals. Any adapter boxes required for this purpose are in the contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc.

10.00.00 TEMPERATURE –RISE

The temperature rise of the horizontal and vertical busbars and main bus links including all power draw-out contacts when carrying 90% of the rated current along the full run shall in no case exceed 55° C with silver plated joints and 40°C with all other types of joints over an outside ambient temperature of 50°C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall

TECHNICAL REQUIREMENTS

not exceed 20°C. The temperature rise of manual operating means shall not exceed 10°C for metallic & 15°C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current. The above temperature rise limits are applicable for busducts also without any current derating.

11.00.00 DERATING OF EQUIPMENTS

The Contractor shall ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50°C ambient in no case shall be less than 90% of the normal rating specified.

The Contractor shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and ambient temperature of 50°C.

12.00.00 PROTECTION CO-ORDINATION

It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers / MCCBs / motor starters, to provide satisfactory/complete discrimination. Further, the various equipment supplied shall meet the requirements of Type 2 class of Co-ordination as per IS: 13947.

All MCCBs shall be tested using primary injection kit in each switchgear during initial commissioning by the bidder. Such testing procedures shall be furnished during detailed engineering. Complete discrimination between incomer and outgoing breaker/MCCB feeders, Upstream and Downstream breakers/MCCB must be established by bidder at time of commissioning.

13.00.00 TESTS AND TEST REPORTS

13.01.00 GENERAL

(a.) The following type test certificates of LT Switchgear and MCC panels shall be submitted.

1)	Circuit breaker of each rating	
	a)	Test sequence 1
	b)	Combined test sequence (With Circuit breakers mounted inside the Switchgear panel)
2)	Complete design verification of Switchgear/MCC Panels as per IEC 61439 Part-1, Annexure-D	
3)	Internal arc test for Personnel and Assembly Protection as per IEC/TR 61641. Test shall be conducted for breaker compartment, busbar chamber, incoming side of smallest sized module, outgoing terminals of module in cable alley.	
4)	MCC modules of any three ratings, as selected by the Employer, for class - II protection Co-ordination as per IS 13947-4-1 / IEC 60947-4-1.	

TECHNICAL REQUIREMENTS

For the following equipment the contractor shall submit the reports of all the type tests

- (a.) NUMERICAL RELAYS
- (b.) LOCAL PUSH BUTTON STATION
- (c.) LOCAL MOTOR STARTER
- (d.) MCCB

13.02.00 Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for Employer's review.

S. No.	TEST ITEMS	Standard
1	Dimensions of structure and visual inspection	IEC 60297-3-101
2	Functional requirements: – Steady-state simulation – Dynamic simulation	Relevant IEC 60255-100 series
3	Product safety requirements (including the dielectric tests and thermal short time rating)	IEC 60255-27
4	EMC requirements: – Emission – Immunity	IEC 60255-26
5	Energizing quantities: – Burden – Change of auxiliary energizing quantity	N/A IEC 60255-11
6	Contact performance	N/A
7	Communication requirements	Relevant IEC protocol standards
8	Climatic environmental requirements: – Cold – Dry heat – Change of temperature – Damp heat	IEC 60068-2-14, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-78, IEC 60068-2-30, IEC 60255-27
9	Mechanical requirements: – Shock – Vibration – Bump – Seismic	IEC 60255-21-1, IEC 60255-21-2, IEC 60255-21-3
10	Enclosure protection	IEC 60529, IEC 60255-27

13.03.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

13.04.00 The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

13.05.00 Routine checking to observe compliance to degree of protection, first numeral, on switchboard enclosures and busbar chambers shall be as under :

TECHNICAL REQUIREMENTS

1) IP -4 X	It shall not be possible to insert a one mm dia. Steel wire into the enclosure from any direction, without using force.
2) IP-5X	It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.

14.00.00 ERECTION / INSTALLATION OF SWITCHBOARDS AND OTHER EQUIPMENTS

15.00.00 COMMISSIONING OF LT SWITCHGEARS

Commissioning of LT switchgears at site shall only be carried out either by the switchgear manufacturer himself or under the supervision of the switchgear manufacturer.

16.00.00 RESPONSIBILITY OF THE ASSOCIATE/COLLABORATOR (APPLICABLE IF LT SWITCHGEAR IS SUPPLIED THROUGH PROVENNESS CRITERIA: ROUTE-2):

The Associate/Collaborator (as applicable) for sourcing of LT Air Circuit Breaker shall be fully responsible and accountable for the item supplied and its compliance to the specification requirements.

The Associate/Collaborator (with respect to his manufactured and supplied LT Air Circuit Breaker) shall:

- i) Participate in the Inspection of the LT Switchgears at Switchgear Supplier's Works, if required by Employer.
- (ii) Participate in Technical Co-ordination Meetings (TCMs) from time to time during detailed engineering, if required.
- (iii) Participate in Site Testing and Commissioning of LT Switchgears, if required.
- (iv) Participate/address/resolve the issues raised during Contract Execution Period.

PART-B
VOLUME – II
CHAPTER – II-E11
BATTERY

TECHNICAL REQUIREMENTS

BATTERY AND DC HEALTH MONITORING SYSTEM

1.00.00 BATTERY RATINGS

1. For Ni-Cd Type Battery		
a)	Battery Voltage	220V/110V/48 V DC
b)	No. of Cells	As per Sizing Calculations
c)	Battery type	Stationary Nickel-Cadmium Pocket Plate High discharge type (KPH)
d)	Capacity for five(5)hour rate	As per requirement
e)	Nominal discharge voltage per Cell	1.2 V
f)	Float voltage	As per manufacturer's standards for float application
2. For Lead Acid Plante type Battery		
a)	Battery Voltage	220V/110V/48 V DC
b)	No. of Cells	As per Sizing Calculations
c)	Battery type	Stationary Lead Acid Plante high discharge type
d)	Capacity for ten(10)hour rate	As per requirement
e)	Nominal voltage per cell discharge	2.0 V
f)	Float Voltage	As per manufacturer's standards for float application

1.01.00 Commissioning of Battery

Commissioning of each battery at site shall only be carried out either by the battery manufacturer himself or under the supervision of the battery manufacturer.

TECHNICAL REQUIREMENTS

PART-A: NICKEL-CADMIUM BATTERY

2.00.00 CODES AND STANDARDS

2.01.00 All standards, specifications and codes of practice referred to herein, shall be the latest editions including all applicable official amendments and revisions as on date of opening of techno-commercial bid.

In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes:

IEC 60623 / IS 10918 Specification for vented type Nickel Cadmium Batteries.

IS 1069 Quality tolerances for water for storage batteries

IEC 60993 Electrolyte for vented Nickel-Cadmium cells

Indian electricity rules

Indian Electricity Acts

2.02.00 Equipment complying with other internationally accepted standards such as IEC., BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.

3.00.00 GENERAL TECHNICAL REQUIREMENT

3.01.00 Equipments

(a.) DC Batteries shall be stationary Nickel Cadmium Pocket plate type (KPH)/ (KPL) conforming to IS 10918. The batteries shall be high discharge performance type as specified. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered.

(b.) DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell.

(c.) Batteries should be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.

3.02.00 Construction Features

TECHNICAL REQUIREMENTS

3.02.01 Containers

Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistance, leak proof, non absorbent, alkali resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of translucent containers.

3.02.02 Vent Plugs

Vent plugs shall be provided in each cells. They shall be anti-splash type, having more than one exit hole shall allow the gases to escape freely but shall prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.

3.02.03 Plates

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS 10918.

The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion.

The positive and negative terminal posts shall be clearly marked.

3.02.04 Sediment Space

Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

3.02.05 Electrolyte

The electrolyte shall be prepared from battery grade potassium hydroxide conforming to IEC 60993.

The cells can be shipped either in charged condition or in dry condition.

Necessary electrolyte for make-up shall be supplied separately.

3.02.06 Connectors and Fasteners

Nickel plated copper connectors shall be used for connecting adjacent cells and PVC insulated flexible copper cables shall be used for inter-row / inter-tier / inter-bank connections. Bolts, nuts and washers shall be Stainless Steel / Nickel coated steel to prevent corrosion. The thickness of Nickel coating of connectors should be not less than 0.02 mm. All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded AL conductors and XLPE insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the contractor. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Contractor shall furnish necessary sizing calculations to prove compliance to the same. Suitable number of Inter-rack connectors shall be supplied by the Bidder to suit the battery room layout during detailed engineering.

TECHNICAL REQUIREMENTS

3.02.07 Battery racks

Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plates, resistant to alkali, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor.

Wherever racks are transported in dismantled conditions, match markings shall be provided to facilitate easy assembly.

3.02.08 Manufacturer's Identification System

The following information shall be indelibly marked on outside of each cell.

- (a.) Manufacturers' name and trade marks
- (b.) Country and year of manufacture.
- (c.) Manufacturer type designation.
- (d.) AH capacity at 5 hour discharge rate.
- (e.) Serial number

4.00.00 THE FOLLOWING INFORMATION SHALL BE GIVEN ON THE INSTRUCTION CARDS SUPPLIED WITH THE BATTERY:

- (a.) Manufacturer's instructions for filling and initial charging of the battery together with starting and finishing charging rate.
- (b.) Maintenance instructions.
- (c.) Designation of cell in accordance with IS 10918.
- (d.) Storing conditions of electrolyte.

5.00.00 TESTS

5.01.00 All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of techno-commercial bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

TECHNICAL REQUIREMENTS

- 5.02.00 However, if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of techno-commercial bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.
- 5.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- 5.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design change". Minor changes if any shall be highlighted on the endorsement sheet.
- 5.05.00 GENERAL
- The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146 (for all applicable tests for containers) / IS-10918 (for Ni-Cd batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.
- 5.06.00 Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.
- 5.07.00 Commissioning Checks:
- All tests as listed below shall be carried out on sample cell selected at random by the employer at site after completion of installation.
- (a.) Physical Examination
 - (b.) Dimensions, Mass & layout
 - (c.) MARKING
 - (d.) Polarity and absence of short circuit.
 - (e.) Ampere - hour capacity--4 Cycles
 - (f.) Insulation resistance
- The Contractor shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments.

TECHNICAL REQUIREMENTS

PART-B: LEAD –ACID PLANTE BATTERY

6.00.00 CODES & STANDARDS

6.01.00 All standards, specification and codes of practice, referred to herein, shall be the latest edition including all applicable official amendments and revisions as on date of opening of techno-commercial bid.

In case of conflict between this specification and those (IS Codes Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes:

IEC 60896	Stationary Lead-Acid Batteries
IS 266	Specification for sulphuric acid
IS 1069	Specification for water for storage batteries
IS 1146	Specification for rubber & plastic containers for lead acid storage batteries.
IS 1652	Specification for stationary cells and batteries, lead acid type (with plante positive plates).
IS 3116	Specification for sealing compound for lead acid batteries.
IS 8320	General requirements and methods of tests for lead acid storage batteries.
IS 6071	Specification for synthetic separators for lead acid batteries.

Indian Electricity Rules

Indian Electricity Acts

6.02.00 Equipment complying with other internationally accepted standards such as IEC, BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards alongwith copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.

TECHNICAL REQUIREMENTS

7.00.00 GENERAL TECHNICAL REQUIREMENTS

7.01.00 Equipments

DC Batteries shall be stationary lead acid Plante positive plate type conforming to IS 1652. The battery shall be high discharge performance type. For the purpose of design an ambient temperature of 50 degree centigrade and relative humidity of 85% shall be considered.

DC Batteries shall be suitable for standby duty. The Batteries shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 2.7 volts per cell maximum and float charged at about 2.25 V/cell:

Batteries should be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.

7.02.00 Construction Features

7.02.01 Containers

Containers shall be made of transparent glass, hard rubber, suitable robust, heat resistance, leak proof, non absorbent, acid resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of transparent containers. Float type level indicator shall be provided in case of opaque containers. The stem portion of the float should be long enough to prevent falling of the float inside the container even if there is no electrolyte in the container. The marking for the electrolyte level should be for the upper and lower limits. The material of level indicator shall be acid proof and oxidation proof. Container shall be closed/sealed lid type. Lid and sealing compound shall be non-cracking type. The container made of hard rubber and plastics shall be type tested as per IS 1146. All type tests shall be carried out for sealing compound as per IS 3116.

The pole sealing arrangement should be such that no acid particle get entrapped due to acid creep as a result of capillary action and it should be possible to remove and refix the sealing to carry out the maintenance.

7.02.02 Vent Plugs

Vent plugs shall be provided in each cells. They shall be anti-splash type, having more than one exit hole shall allow the gases to escape freely but shall prevent acid from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte sample.

7.02.03 Plates

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS 1652 as applicable.

The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative post shall be clearly marked.

TECHNICAL REQUIREMENTS

7.02.04 Sediment Space

Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.

7.02.05 Cell Insulator

Each cell shall be separately supported on PVC/porcelain/hard rubber insulators fixed on the racks with adequate clearance between adjacent cells. Minimum distance between adjacent cells shall be more than the bulge allowed for two cells in accordance with IS 1146.

7.02.06 Electrolyte

The electrolyte shall be prepared from battery grade sulphuric acid conforming to IS 266 and distilled water conforming to IS 1069. The cells shall be shipped dry uncharged. The electrolyte shall be supplied separately.

7.02.07 Connectors and Fasteners

Lead or Lead coated copper connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. The thickness of lead-coating of connectors should not be less than 0.025 mm. The lead coating thickness shall be measured in accordance with APPENDIX F of IS 6848 (latest edition). All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds. End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded copper conductors and PVC insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied by the contractor. All connectors and lugs shall be capable of continuously carrying the 30 minutes discharge current of the respective Batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Contractor shall furnish necessary sizing calculations to prove compliance to the same.

7.02.08 Battery racks

Wooden racks for all the batteries shall be provided. These racks shall be made of good quality first class seasoned teak wood in line with CPWD specification. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries rack and wooden support for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade. Numbering tags, resistant to acid, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor. Wherever racks are transported in dismantled condition, suitable match markings shall be provided to facilitate easy assembly.

7.02.09 Manufacturer's Identification Systems

The following information shall be indelibly marked on outside of each cell.

TECHNICAL REQUIREMENTS

- (a.) Manufacturer's name and trade marks
- (b.) Country and year of manufacture.
- (c.) Manufacturer type designation.
- (d.) AH capacity at 10 hour discharge rate.
- (e.) Serial number

8.00.00 TESTS

8.01.00 All equipment to be supplied shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of techno-commercial bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

8.02.00 However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of techno-commercial bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

8.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

8.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design change". Minor changes if any shall be highlighted on the endorsement sheet.

8.05.00 GENERAL

The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146 (for rubber & plastic containers for lead-acid storage batteries)/IS 1652 (for lead-acid plate batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

8.06.00 Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of battery.

8.07.00 Commissioning Checks:

All tests as listed below shall be carried out on sample cell selected at random by the employer at site after completion of installation.

- 1) Verification of markings.

TECHNICAL REQUIREMENTS

- 2) Verification of dimensions.
- 3) Test for capacities for 10 hrs discharge rate alongwith the test for voltage during discharge.

The Contractor shall arrange for all necessary equipment, including the variable resistor, tools, tackles and instruments.

PART-B
VOLUME – II
CHAPTER – II-E12
BATTERY CHARGER

TECHNICAL REQUIREMENTS

BATTERY CHARGER (SCR/SMPS)

1.00.00 CODES AND STANDARDS

ANSI-C 37.90a	Guide for surge withstand capability tests
IS:5	Colours for ready mix paints.
IS : 694	PVC Insulated Cable for working voltages upto and including 1100 V.
IS : 1248	Specification for Direct acting indicating analogue electrical measuring instruments.
IS:13947 Part-1	Degree of protection provided by enclosures for low voltage switch gear and control gear.
IS : 13947	Specification for low voltage switch gear and control gear
IS : 3231	Electrical relays for power system protection.
IS : 3842	Application guide for Electrical relays for AC System
IS : 3895	Mono-crystalline semi-conductor Rectifier Cells and Stacks
IS : 4540	Mono crystalline semi-conductor Rectifier assemblies and equipment.
IS:6005	Code of practice for phosphating of Iron and Steel.
IS:6619	Safety Code for Semi-conductor Rectifier Equipment.
IS:11171/ IS:2026	Rectifier Transformer
IS:6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto 1000 V AC or 1200 V DC.

TECHNICAL REQUIREMENTS

IS : 9000	Basic environmental testing procedures for electronic and electrical items.
IS:13703	Low voltage fuses for voltages not exceeding 1000 V AC or 1500 V DC.
EEUA-45D	Performance requirements for electrical Alarm Annunciation System
	Indian Electricity Rules
	Indian Electricity Act.
EN 61000-6 -4:2007 (CE& RE CLASS A)	Emission For SMPS module
EN 61000-6-2:2005	Immunity For SMPS module
EN 60950-1(CE).	Safety Standard For SMPS module

2.00.00 Technical Parameters

1.	Mode of Charging	Float cum Boost Charger (Automatic and Manual Mode)
2.	Charger Ambient Temp / RH	50 deg C, 95%
3	I/P Voltage Rating (AC)	415V +15%/-20% 3 Phase 3W
4.	Voltage Rating (DC)	220V/110V
5.	Trickle Charging	1.4-1.42V per cell(Ni-Cd) 2.25V per cell(Lead-Acid)
6.	Boost Charging Mode	1. 53-1.7V per cell(Ni-Cd) 2. 3-2.7 V per cell(Lead-Acid) 3. Boost mode enable only with DCDB incomer OFF.
7.	Automatic Voltage regulator (trickle Mode)	±0.5% at 415 ± 10% and 0-100% Load
a.	Load Limiter current setting Range(Trickle Mode)	80%-100%
b.	% Stabilization of the output DC voltage	1% for +15%/-20% input supply variation and 0-100% DC load
c.	Voltage Range and Stabilizing time for momentary load changes from 20%-100% and Vice versa	+/- 3% and less than 1 secs
d.	Dynamic Response Time	Less than 1 secs

TECHNICAL REQUIREMENTS

8.	Current setting range in Boost Charging Mode	50-120% of rated Boost current
9.	Voltage limit setting range in Boost Charging Mode	Boost charging limit
10.	Rectifier Type	Static Type Full wave Rectifier / SMPS
11.	Ripple Content	1% Peak-Peak at 0-100% of DC Load
12.	Transformer (power frequency)	Dry and Air Cooled(AN) type Class-F Insulation with temp rise limited to Class-B at 50deg C Ambient
13.	Transformer (high frequency)	Ferrite core type
14.	Power Factor	0.9 at Rated Load
15.	Efficiency	≥ 85% at Full Load
16.	THDi	10% at 90-100% load, ≤ 15% at 0-90% load
17.	Charger Enclosure	IP42

3.00.00 EQUIPMENT DESCRIPTION (SCR/SMPS)

- (a.) The Battery Chargers as well as their automatic regulators shall be of static type Either SCR Based or SMPS Based Modular. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC lead-acid . / Ni-cad Batteries while supplying the D.C. loads.
- (b.) All Battery Chargers shall have provision to receive two input supplies (415V +15%/-20% 3 Phase 3 Wire) along with suitable automatic changeover between the sources. Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. Trickle or Boost charging and automatic/manual mode.
- (c.) The chargers shall be capable of limiting the voltage or current in case DC load current exceeds the load limiter setting of the Charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall neither damage the Charger nor shall it cause blowing of any of the charger fuses. The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided by the Employer in the DC distribution board for remote annunciation.
- (d.) ~~For SCR Based Charger Digital indicating instruments with in-built communication port for remote data transfer shall be provided for all chargers.~~

TECHNICAL REQUIREMENTS

~~Ammeters & voltmeters shall have 4-20mA analog output for current and voltage respectively.~~

For SMPS/SCR Based Charger all indication & metering values to be provided in LCD Display (Min. 7 Inches) and 4-20mA transducer to be provided for analog output for current and voltage respectively. 76mmx76mm (min) Voltmeter (DC) and Ammeter (DC) is to be provided for local display.

- (e.) Blocking diode shall be provided in the output circuit of each Charger to prevent current flow from the D.C. Battery into the SCR Based Charger.

In SMPS based chargers, blocking diode shall be provided in each rectifier module. It can be part of rectifier module itself.

- ~~(f.)~~ Digital Outputs shall be configured for connection to the DC health monitoring system for real-time charger status updation.

- (g.) For all Power Components (contactors, MCCBs, fuses, relays, metering instruments etc) and constructional details (sheet thickness, paint shade, gland plate thickness etc) of charger enclosure and internal wiring details, refer relevant clauses in LT switchgear specifications (as applicable).

- (h.) Live busbars, parts etc shall not be accessible while the charger is in energized condition. Suitable safety interlocks to be ensured.

- (i.) Surge protection device of Class -C type shall be provided in input side of charger. N+N/5 no of SMPS modules shall be provided in each chargers

3.1.00 Semiconductor Assembly For SCR Based Charger

The rectifier cells shall be provided with their own heat dissipation arrangement along with forced air cooling for above 400A rating chargers and fan shall be temperature controlled with 100% standby redundancy. The rectifier shall utilize diodes/thyristors and heat sinks rated to carry 200% of the load current continuously and the temperature of the heat sink shall not be permitted to exceed 85°C absolute duly considering the maximum charger panel inside temperature.

Semiconductor Assembly For SMPS Based Charger

Battery charger system shall be static type composed of switch mode power supply (SMPS) modules or SMR modules. The rectifier module shall be microprocessor controlled, Power MOSFET based, high frequency with active load sharing, modular in construction designed for single and parallel operation with battery and shall be provided with heat sink having their own heat Dissipation arrangements incase of forced air cooling of temperature based ON/OFF cooling system.

3.2.00 Output Controller/Annunciation System

The charger system shall be provided with HMI display unit having touch (Min 7 inch) facility to read all the charger parameters like input voltage, output & battery voltage, charging/discharging current, positive & negative earth leakage current with alarm, status & fault display. The selection setting like mode selection (Float/Boost), manual boost voltage & current adjustment can be done by this HMI. The HMI should have SCADA interface to communicate with DDCMIS over IEC 61850. Annunciations for A.C. supply failure, Rectifier fuse failure for SCR based Charger/SMPS Module Fail for SMPS based Charger, Surge circuit fuse failure, Filter fuse failure for SCR Based

TECHNICAL REQUIREMENTS

Charger/SMPS Fail for SMPS based charger, Load limiter operated, Charger trip, Battery on Boost shall be integrated in the same HMI.4-20 mA Analog output for load current /voltage shall be provided for integrating to DDCMIS. Potential free NO contacts shall be provided for following remote alarms in the Employer's Unit Control Board:

- (a) Battery on Boost
- (b) Charger trouble (this being a group alarm initiated by any of the faults other than 'Battery on Boost')

2.00.00 TESTS

For conductance/report submission/validity of type tests, refer Sub Section-IIB, Section-VI, Part A of technical specifications.

2.01.01 -LIST OF TYPE TESTS

1. The contractor shall furnish the following type tests reports for each rating of the equipment to be supplied under this contract.

a)	Complete physical examination
b)	Temperature rise test at full load. (For chargers of up to 400A rating, Temperature rise test report for rectifier assembly at 200% of full load shall also be submitted.)
c)	Insulation resistance test.
d)	High voltage (power frequency) test on power and control circuits except low voltage electronic circuits.
e)	Automatic voltage regulator operation test at specified A.C. supply variations at no load, half load and full load.
f)	Load limiter operation test
g)	Efficiency, power factor measurement & THDi
h)	Surge withstand capability test at the following points of the Charger: <ul style="list-style-type: none">i) Across each A.C. input phaseii) Across AC input line to ground.iii) Across D.C. output terminals.

TECHNICAL REQUIREMENTS

	<p>iv) Across each D.C. output terminal to ground</p> <p>The Charger shall not exhibit any component damage and there shall be no change in performance as per (g) and (h).</p>
	<p>i) Environmental Tests</p> <p>Steady state performance tests (f) and (g) shall be carried out before and after each of the following tests.</p> <p>i) Soak Test</p> <p>ii) Degree of protection test.</p>
2.	<p>Dynamic response test and Temperature rise test at full load shall be carried out on each charger before dispatch at manufacturer's works.</p>
	<p>Short Circuit Test at no Load</p>

3.00.00 COMMISSIONING TESTS

3.01.01 Bidder shall submit commissioning test procedure including details of all commissioning checks before commissioning the system at site.

PART-B

VOLUME – II

CHAPTER – II-E13

GT and OIL FILLED TRANSFORMERS

TECHNICAL REQUIREMENTS

This chapter has to be read in conjunction with sub-section B-0 "General electrical specification" of technical specification Section- VI, Part-B and Sub-Section-IIB Electrical system/Equipment of Technical Specifications Section-VI, Part-A.

1.00.00 POWER TRANSFORMERS, AUXILLARY OIL FILLED TRANSFORMERS

1.01.00 TYPE & RATINGS (for continuous duty)

Sr. No.	TRANSFORMER	Generator Transformer (GT)	Auxiliary Transformer (including LT Outdoor)
i)	Rating (MVA)	As per system requirement/SLD/Sub section B-0, B-04	
ii)	Voltage Ratio (KV)	Generation Volt/ 34.5	As per system requirement/SLD/B-0
iii)	Winding	2	2
iv)	Nos. of Phase	Three	
v)	Vector Group	As per system requirement/SLD/ B-0, B-04	
vi)	Cooling	ONAN	
vii)	Tap Changer	As per system requirement/ Sub section B-0, B-04/SLD	
viii)	Impedance	As per system requirement/Sub section B-0, B-04/SLD	
	At 75°C		
	a) Principal Tap		
	b) Other Taps		
ix)	Permissible Temperature rise over an ambient of 50 deg C (irrespective of tap)		
	a) Top Oil by thermometer	35 °C	50 °C (40 deg. C for up to & including 2.5MVA and 33KV rating)
	b) Winding by resistance	40 °C	55 °C (45 deg. C for up to & including 2.5MVA and 33KV rating)

TECHNICAL REQUIREMENTS

x)	Insulation level	As per chapter B-0, B-04 Part-B	
xi)	Earthing (Copper Flat)	Solidly Earthed	As per system requirement/ Sub section B-0, B-04/SLD
xii)	Termination, SC withstand time & Fault Level	As per system requirement/ Sub section B-0, B-04/SLD a) Generator Transformer- 3 seconds (**) b) All other transformers- 2 seconds (**) - The indicated values of time durations are used in transformer design for ensuring thermal stability of the transformers and are to be proven through calculations.	
xiii)	Noise level	As per NEMA TR-1	
xiv)	Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/- 10%, also transformer shall be capable of being loaded in accordance with IS 2026 part-7/ IEC 60076 part-7. In addition, GT shall be able to operate at full load for at least ten (10) minutes without exceeding the calculated winding hot spot temperature of 140°C in the event of complete failure cooling equipment applicable.	
xv)	Air Core Reactance	At least 20% for HV winding for GT	
xvi)	Flux Density	Not to exceed 1.9 Wb/sq. m. at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations:	
		a) 110% for continuous rating.	
		b) 125% for at least one minute.	
		c) 140% for at least five seconds.	
		Bidder shall furnish over fluxing char. up to 150% & 170 % for GT	

Note: -

- 1). Not used.
- 2). Not used.
- 3). LT Auxiliary transformers shall be 3 phase, 4 wire system with additional LVN bushing for equipment earthing.

1.02.00 NOT USED.

1.03.00 NOT USED.

1.04.00 CODES AND STANDARDS

Transformers	IS:2026, IEC:60076, IS 1180
Bushings	IS:2099, IEC:60137
Insulating oil	IEC:60296
Bushing CTs	IS:2705, IEC 61869
Indian Electricity Act 2003, BEE Guideline & CEA notification	

TECHNICAL REQUIREMENTS

1.05.00 OPERATIONAL REQUIREMENT

1.05.01 Transformers

- a) Generator transformers shall be suitable for back charging. It shall be capable of being charged from HV side and kept charged continuously with no load on the LV side without any adverse impact on the transformer life.

Cooling requirements

- i) Transformers: The radiators shall be detachable type, mounted on the tank. Each radiator shall be provided with a drain plug/valve at the bottom, an air release plug at the top, shut off valve at each point of connection to the tank.
- ii) The radiators shall be made of Hot Dipped Galvanized Steel conforming to ISO 12944-5:2018, Table D.1, System no. G5. 05 of paint and coating of the Table D.1.

b) Other Requirement

- i) Phase to Earth clearances (34.5 kV): 320 mm min.
- c) OLTC (as applicable)
- i) Local control, both manual and electrical
- ii) Remote electrical control with necessary relays (as required)
- iii) Safety interlocks and protection
- iv) Remote Tap position signal
- v) Tie-in resistors requirement, if any, may be confirmed and provided.
- d) Not used.
- e) LT Auxiliary outdoor transformers up to and including 2500 KVA, 33 kV shall have maximum losses of STAR-2 rating or better as per latest BEE guideline. The outdoor transformer up to 2500 KVA, 33 kV shall also comply with latest IS:1180.

1.05.02 Not used.

1.06.00 DESIGN AND CONSTRUCTIONAL FEATURES

1.06.01 NTPC may at their discretion have design review done to check the design of the transformers by NTPC/their consultant.

1.06.02 Tank

- a) Tank shall be of welded construction & fabricated from tested quality low carbon steel of adequate thickness.
- b) The main tank body including tap changer, radiators (except for Auxiliary transformers) shall be capable of withstanding full vacuum. Tank shall be provided with suitable lifting lugs, minimum 4 jacking pads & haulage holes for wheeling in all four directions. The GT Tank shall be preferably Bell type. Bell Type Tank bolted

TECHNICAL REQUIREMENTS

joint shall be at about 500 mm above bottom of the tank and shall have 4 nos. of lifting pads on bell Tank cover so as to lift it for rim gasket replacement.

- c) GT & transformers located at Transformer yard shall be mounted on detachable type bi-directional rollers for rail gauge of 1676 mm. Auxiliary transformers shall have suitable bi-directional skids, however auxiliary transformers above 2 MVA shall be provided with four no. of bi-directional detachable flat rollers. Suitable locking arrangement shall be provided to prevent accidental movement of transformer.
- d) At least two adequately sized inspection openings, one at each end of the tank for easy access to bushings and earth connections & suitable manhole shall be provided.
- e) The base of each tank shall be so designed that it shall be possible to move the complete transformer unit by skidding in any direction without damage when using plates or rails and the base plate shall have following minimum thickness. (For GT only)

Length of tank	Minimum Thickness (mm)
Flat bases Over 2.5 m but less than 5m	20
Flat bases Over 5 m but less than 7.5m	26
Flat bases Over 7.5 m	32

1.06.03

Core

Transformer	Requirement
GT	Core shall be high grade, non-ageing, cold-rolled, super grain-oriented silicon steel laminations known as Hi B grade steels or equivalent. The insulation of core to tank, tank to clamp and clamp to core shall be able to withstand a voltage of 10 kV rms (for GT) for 1 min in air. To facilitate testing of above during pre-commissioning stage, the core/clamp earthing has to be done outside the tank with suitable bushings.
Auxiliary Transformers	Core shall be high grade non-ageing cold rolled super grain oriented silicon steel laminations of M4 grade or better quality. The core isolation shall be able to withstand a voltage of 2 kV (rms.) for 1 minute in air.

1.06.04

Insulating oil

No inhibitors shall be used in the transformer oil. The oil supplied with transformers/ reactor shall be new and previously unused and must conform to following while tested at supplier's premises and shall have following parameters.

S. No.	Property	Permissible values
1.	Kinematic Viscosity, mm ² /s	£ 12 at 40 ° C

TECHNICAL REQUIREMENTS

S. No.	Property	Permissible values
		£ 1800.0 at (-)30 ° C
2.	Flash Point, ° C	³ 140° C
3.	Pour point, ° C	£ (-)40 ° C
4.	Appearance	Clear, free from sediment and suspended matter
5.	Density kg/dm ³ at 20 ° C	£ 0.895
6.	Interfacial Tension N/m at 25° C	³ 0.04
7.	Neutralization value, mgKOH/g	£ 0.01
8.	Corrosive sulphur	Non-Corrosive
9.	Water content mg/kg	£ 30 in bulk supply £ 40 in drum supply
10.	Anti-oxidants additives	Not detectable
11.	Oxidation Stability -Neutralization value, mgKOH/g -Sludge, % by mass	£ 1.2 £ 0.8
12.	Breakdown voltage As delivered, kV After treatment, kV	³ 30 ³ 70
13.	Dissipation factor, at 90° C And 40 Hz to 60 Hz	£ 0.005
14.	PCA content	£1%
15.	Impulse withstand Level, kVp	³ 145
16.	Gassing tendency at 50 Hz after 120 min, mm ³ /min	£ 5

Subsequently oil samples shall be drawn at:

Sr. No.	Parameters	Before filling in main tank at site & tested for	Prior to energization at site for following properties & acceptance norms:	Applicability
i)	BDV	60 kV (min)	60 kV (min)	Applicable for all Transformers
ii)	Moisture content	10 ppm (max.)	10 ppm (max.)	
iii)	Tan delta at 90 deg. C	0.005 (max.)	0.05 (max.)	Applicable for GT
iv)	Interfacial tension	0.04 N/m(min)	0.035 N/m (min)	

1.06.05 Windings

The conductors shall be of Electrolytic grade copper. All Windings of 66 kV and below shall have uniform insulation. The contractor shall ensure that windings are made in dust proof & conditioned atmosphere. All windings of GT shall have thermally upgraded paper covering insulation.

For GT, winding paper moisture shall be less than 0.5%.

1.06.06 Oil preservation

Main tank and OLTC (if applicable) shall be provided with conservator tanks of adequate capacity for expansion of oil from minimum ambient to 100 deg. C. GT and

TECHNICAL REQUIREMENTS

equipment rated 7.5 MVA and above shall be provided with air bag breathing through indicating type cobalt free silica gel breather with transparent enclosure (refer fittings clause for breather type applicable for GT). However conventional type conservator with indicating type cobalt free breather (transparent enclosure) shall be offered for transformer below 7.5 MVA.

For GT, Conservator Protection Relay (CPR)/Air cell puncture detection relay shall be externally installed on the top of conservator to give alarm in the event of lowering of oil in the conservator due to puncture of air cell in service.

1.06.07 Bushings

- (a.) The electrical & mechanical characteristics of bushings shall be in accordance with IS: 2099, IS: 3347, IS: 12676 & IEC: 60137.
- (b.) Bushings below 52 kV shall be with porcelain insulator and shall be of oil communicating / OIP (non-oil communicating type) / epoxy RIP type. All condenser bushings shall be non-communicating type.
- (c.) Not used.
- (d.) The oil end dimension of RIP bushing shall be same for all bushings of similar voltage rating.
- (e.) All condenser bushings shall be non-communicating type.
- (f.) Condenser type bushings shall be provided with:
 - i) Oil level gauge
 - ii) Oil filling plug
 - iii) Tap for capacitance and Tan delta test
- (g.) Clamps & fittings shall be of hot dip galvanized steel.
- (h.) Bushing & fittings shall be provided with vent pipes that shall be connected to route any gas collection through the Buchholz relay.
- (i.) No arcing horns shall be provided on the bushings.
- (j.) LV Bushing palm shall be Silver/Tin plated.
- (k.) Not used.

1.06.08 Bushing CTs

Shall be of adequate rating for protection as required, WTI etc. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted. All CT terminals shall be provided as fixed type terminals on the M. Box to avoid any hazard due to loose connection leading to CT opening or any other loose connection in power circuit. In no circumstances Plug In type connectors shall be used for CT & Power connection.

1.06.09 Tap changer (as applicable)

TECHNICAL REQUIREMENTS

- i) Not used.
- ii) The OLTC chamber oil shall not come in contact with main tank oil.
- iii) Tap Changer drive marshalling box shall be provided for GT, transformers (as applicable).
- iv) For GT, transformers tap changer shall be provided with an analog signal (4-20 mA) for tap position of transformer.

1.06.10

Marshalling box

- i) For transformers 1 no. M. Box shall be provided for each unit.
- ii) Not used.
- iii) M. Box shall be of stainless steel (SS-316 or better), at least 2.5 mm thick, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. The gasket used shall be of neoprene rubber. Also Marshalling Box gland plate shall be at least 450 mm above ground level.
- iv) GT shall be provided with two auxiliary power supplies, 415V, three phase, 4 wire shall be drawn from two separate boards for the M. Box. In case of one power supply failure, loads shall be automatically transferred to other. The supplier shall derive AC feeders for OLTC cabinet (if applicable) after suitable selection at M. Box. No components (except heater & it's switch, light & sockets) shall be mounted on side & top wall of Marshalling Box e.g. relay, timer, contactors, MCBs. TBs etc.
- v) Not used.
- vi) Not used.
- vii) For transformer, wiring scheme shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.
- viii) TB shall be stud type for all CT & Power connections with ring type lugs.
- ix) Not used.
- x) Terminal block numbering for transformer shall be made in line with tender drawing no. 0000-203-PVE-B-001 respectively.

1.06.11

Valves

- (a.) All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies with gun metal fittings.
- (b.) Sampling & drain valves should have zero leakage rate.

1.06.12

Gaskets

- a) For GT all the gasket shall be weather proof & hot oil resistant of 'O' ring of Nitrile rubber for all valves, flanges, HV, LV & Neutral Turrets, Bushings, Tank rim, etc. For

TECHNICAL REQUIREMENTS

this, all the flanges shall be machined. However, GT, LV turret to Tank joint shall be provided with "Fluor elastomers" cord gasket.

- b) For Auxiliary Transformers gasket shall be fitted with weatherproof, hot oil resistant, rubberized cork gasket.
- c) Not used.
- d) If gasket is compressible, metallic stops shall be provided to prevent over compression.
- e) The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating for a continuous period of at least 3 months during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period of 3 months of the same. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established.

1.06.13 Transformer Transportation

Transportation shall be N2/Dry Air/Oil filled. GT shall be transported with sufficient number (minimum two nos.) of impact recorders with necessary arrangement to maintain N2/Dry air pressure (as applicable) during transit and storage.

1.06.14 PAINTING

PARTS NAME	TYPE OF PAINT	NO.OF COATS	TOTAL DFT
Inside of tank and accessories (except M Box)	Oil & heat resistant fully glossy white	One coat	At least 30 micron
External surface of transformer and accessories	Chemical resistant epoxy zinc phosphate primer, MIO (Micaceous iron oxide) as intermediate paint followed by	One coat each	At least 100 micron

TECHNICAL REQUIREMENTS

PARTS NAME	TYPE OF PAINT	NO.OF COATS	TOTAL DFT
(except radiators)	polyurethane finish paint (RAL 5012 Blue)		
External Radiator surface	ISO 12944-5:2018, Table D.1, System no. G5.05 of priming and painting with high quality full glossy outer finish paint (RAL 5012 Blue)	As per ISO 12944-5:2018, Table D.1, System no. G5.05	As per ISO 12944-5:2018, Table D.1, System no. G5.05
Internal Radiator surface	Hot oil proof, low viscosity varnish and subsequent flushing with transformer oil	---	---

1.07.00 Monitoring System of GT

The supervision, control and communication of various operating conditions and condition monitoring of GT shall be done through SAS/DCS/plant control system.

1.08.00 Neutral Earthing Arrangement

- i) In case of Generator Transformers, neutral shall be solidly grounded via 2 nos. copper flats.
- ii) The neutral of transformers shall be brought through insulated support from tank to the ground level at a convenient point with copper flat, for connection to ground network (as applicable). However neutral may be connected to NGR (Neutral Grounding Resistor) as per system requirement.

1.09.00 NGR (Neutral Grounding Resistor) (As per system requirement)

1.	Resistance at 50°C	As per system requirement
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TECHNICAL REQUIREMENTS

2.	Rated current	600A for 10 seconds
3.	Application	Neutral Grounding of Transformers as per system requirement
4.	Service	Outdoor
5.	Resistor material & connection	Punched stainless steel grid element type
6.	Max allowable temp rise over amb. of 50°C	350 deg. C
7.	Mounting	As per system requirement
8.	Power frequency level	As per system requirement
9.	Stacking	Various sections comprising the neutral grounding resistor shall be capable of being stacked one above the other.
10.	Enclosure	NGR shall be housed in a 2.5 mm thick sheet steel enclosure & DOP IP-33. A heating circuit with Thermostat to be provided inside the enclosure to control humidity.
11.	Mounting Structure	The Contractor shall supply and erect a galvanized structure to support the NGR enclosure so that the base of the enclosure shall be at a minimum height of 2.4M above ground level.

1.10.00 FITTINGS

Following fittings shall be provided with Transformers covered under this specification.

a)	-Conservator for main tank with MOG (with low oil level alarm contact), drain valve & indicating type Cobalt free breather with transparent enclosure (maximum height 1400 mm above rail level) etc. Aircell (for GT and transformers 7.5 MVA & above). -Conservator for OLTC tank with Oil level gauge, indicating type Cobalt free Breather & drain valve.
b)	-Buccholz relay (magnetic type), double float type with alarm and trip contacts (with plug & socket type arrangement), along with suitable gas collecting device. - Oil surge relay to be provided for OLTC.
c)	- For 2 MVA & above rating transformer/reactor, minimum two numbers of spring-operated PRD (with trip contacts with plug & socket type arrangement) with suitable discharge arrangement for oil shall be provided. Armored cable be used between PRD to Marshalling box. PRD shall have DOP of IP-67. Plugin type connector shall be provided for proper sealing for terminating cables/ glands. - For transformers below 2 MVA, diaphragm type explosion vent shall be provided.
d)	OTI & WTI shall be 150 mm dial type with alarm and trip contacts with max. reading pointer & resetting device. (maximum height 1500 mm above rail level) For GT WTI shall be provided for all windings, also PT-RTD with 4-20 mA

TECHNICAL REQUIREMENTS

	signals shall be provided with OTI & WTI of these transformers.
e)	Top & bottom filter valves with threaded male adapters, bottom sampling valve, drain valve/sludge removal valve at the bottom most point of the tank.
f)	Air release plug, bushing with metal parts & gaskets, terminal connectors on bushings (as applicable).
g)	Prismatic/toughened glass oil gauge for transformers and OLTC chamber.
h)	Followings items are as applicable:- Bi-directional wheel & skids, M. Box, OLTC, OCTC, Bushing CTs, Insulating Oil, Cooling equipment, Valve Schedule Plate.
i)	Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs, additional 4 nos. lifting lugs for bell tank cover, inspection cover, manhole, Bilingual R&D Plate, Terminal marking plates, two earthing terminals etc.
j)	Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS.
k)	Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.
l)	1 no. Rapid Pressure Rise relay for each GT.
m)	OLTC conservator breather shall be provided with conventional non-carcinogenic indicating type breather.
n)	-Online moisture removal system for GT- 02 nos. - For each GT: - Conservator aircell rupture relay.
The fittings listed above are only indicative and other fittings, which generally are required for satisfactory operation of the transformers) are deemed to be included.	

1.11.00 Testing Requirements

1.11.01 Apart from the type test listed in this specification, following components to be supplied shall be of tested design and submit the reports for approval.

- (a.) Not used.
- (b.) All type test on OLTC as per IEC 60214 (wherever applicable)
- (c.) Neutral Grounding Resistors (as applicable)
- (d.) Tank Vacuum and Pressure test

1.11.01a **Type tests criteria for Auxiliary oil filled transformers rated up to 16 MVA, 11 kV (only type test report has to be submitted)**

TECHNICAL REQUIREMENTS

A) The Type Test reports should be of a transformer which is generally similar to the transformer being offered as per IEC 60076-5, Annexure-B and also identical to the offered transformer in the following aspects:

- i) Voltage ratio
- ii) MVA/KVA rating
- iii) Percentage Impedance
- iv) Internal design
- v) Type of tap changer equipment
- vi) Cooling arrangement
- vii) Temperature rise
- viii) Individual and total loss values of the offered transformer shall be same as that indicated in the GTP of transformer for which Type Test Reports are submitted.

B) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

1.11.02 Each transformer shall be completely assembled with all fittings & accessories meant for the particular transformer before offering for inspection & testing by Employer.

1.11.03 **ROUTINE / TYPE TESTS ON TRANSFORMERS :**

I) ROUTINE TEST

S. N.	Transformer Type	GT (3-PH)	Auxiliary Trans.
	Voltage Class	34.5 kV Class	Um ≤ 72.5kV
1.	All routine test in accordance with IEC 60076 shall be carried out in all the transformers.	√	√
2.	Measurement of Voltage Ratio & phase displacement (as per IEC 60076-1)	√	√
3.	Measurement of winding resistance on all the taps (as per IEC 60076-1)	√	√
4.	Vector group and Polarity Check (as per IEC 60076-1)	√	√
5.	Magnetic Balance and	√	√

TECHNICAL REQUIREMENTS

S. N.	Transformer Type	GT (3-PH)	Auxiliary Trans.
	Voltage Class	34.5 kV Class	Um ≤ 72.5kV
	Magnetizing Current Test		
6.	Measurement of no-load current with 415 V, 50 Hz AC supply	√	√
7.	Measurement of no load losses and current at 90%, 100% & 110% of rated voltage (as per IEC 60076-1)	√	√
8.	Load Loss & Short Circuit Impedance Measurement on principal & Extreme Taps	√	√
9.	Insulation resistance measurement & Polarization Index (As per IEC 60076-1)	√	√
10.	2kV / 10 kV core isolation (core-clamp, clamp-tank, core-tank)	√ (10kV)	X
11.	Measurement of capacitance & tan delta between winding to earth and between windings. (For 33 kV & above class transformer, tan delta should not exceed 0.5% at 20 °C, also refer Note-iii below)	√	√
12.	Dielectric tests shall be carried out as per IEC 60076-3.	√	√
13.	Applied Voltage Withstand Test	√	√

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S. N.	Transformer Type	GT (3-PH)	Auxiliary Trans.
	Voltage Class	34.5 kV Class	Um ≤ 72.5kV
	(as per IEC 60076-3)		
14.	Lightning impulse (Full & Chopped Wave) test on windings (as per IEC 60076-3)	X	X
15.	Lightning impulse test on Neutral terminals.	X	X
16.	Switching impulse test (as per IEC 60076-3)	X	X
17.	IVPD test as per IEC 60076-3 shall be conducted (for U1 & U2 level refer Note & Table given below)	X	X
18.	LTAC test as IEC 60076-3 (also refer Table given below)	X	X
19.	Induced overvoltage test	√	√
20.	Repeat no load current/loss measurement & IR after completion of all electrical test	√	√
21.	Oil leakage test on completely assembled transformer along with unit coolers/ radiators (as per relevant clause of this sub section)	√	√
22.	Jacking test followed by D.P. test	√	√

TECHNICAL REQUIREMENTS

S. N.	Transformer Type	GT (3-PH)	Auxiliary Trans.
	Voltage Class	34.5 kV Class	Um ≤ 72.5kV
23.	Frequency Response Analysis test	√	X
24.	Marshalling Box/Cable box: It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.	√	√
25.	Insulation resistance measurement on wiring of Marshalling Box.	√	√
26.	Temperature Rise test at a tap corresponding to maximum losses and at minimum 110 % of rated current of corresponding tap. Gas chromatography shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IEC:61181. Infra-red thermography shall be done during temp rise test, same needs to be measured during last hour of oil rise	√**	X

TECHNICAL REQUIREMENTS

S. N.	Transformer Type	GT (3-PH)	Auxiliary Trans.
	Voltage Class	34.5 kV Class	Um ≤ 72.5kV
	stabilization. Result shall be recorded for future reference.		
27.	Measurement of power taken by the fans and oil pumps	X	X
28.	Measurement of insulation power factor and capacitance of bushings	X	X
29.	Tan delta of bushing at variable frequency (Frequency Domain Spectroscopy)	X	X
30.	Check of the ratio and polarity of built-in current transformers	√	X
31.	Short duration heat run test (Not applicable for unit on which temperature rise test is performed)	X	X
32.	Not used.	X	X
33.	Measurement of dissolved gases in dielectric liquid	√	X
34.	Test on On-load tap changer (Tap changer fully assembled on the transformer)	√	X
35.	Appearance, construction, and dimension check	√	√

TECHNICAL REQUIREMENTS

II) TYPE TEST (#)

S. N.	Transformer Type Voltage Class	GT (3-PH) 34.5 kV Class	Auxiliary Trans. Um ≤ 72.5kV
1.	LTAC test as IEC 60076-3 (also refer Table given below)	X	X
2.	Lightning impulse(Full & Chopped Wave) test on windings (as per IEC 60076-3)	√	√
3.	Lightning impulse test on Neutral	√	√*
4.	Short circuit test (special test) as per IEC 60076-5. In addition, For GT :- i) DGA & FRA shall also be conducted before & after S.C. test. ii) Physical inspection of transformer to be done before S.C. Test in presence of NTPC inspector and photographs to be taken for reference.	√	√
5.	Temperature Rise test at a tap corresponding to maximum losses. Gas Chromatography	X	√

TECHNICAL REQUIREMENTS

S. N.	Transformer Type Voltage Class	GT (3-PH) 34.5 kV Class	Auxiliary Trans. Um ≤ 72.5kV
	shall be conducted on oil sample taken before & immediately after temp. rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599). For ST, DGA results shall be interpreted as per IEC 61181.		
6.	Zero sequence impedance measurement test (Special test)	√	X
7.	Measurement of power taken by the fans & pumps (as applicable)	X	X
8.	Measurement of harmonics of no load current (special test)	√	X
9.	Measurement of acoustic noise level as per NEMA TR-1 (special test)	√	√
10.	Measurement of transferred surge on LV due to HV lightning impulse and IV (as applicable) lightning impulse	√	X
11.	Measurement of transferred surge on LV due to HV Switching impulse and IV (as applicable) Switching impulse	X	X
12.	Not used.	X	X

NOTE:-

- i) (#) All the type/special tests & temperature rise test shall be conducted after performing Short Circuit Test. If Tank Vacuum & Pressure Test is to be carried out then it shall be conducted before SC test.
- ii) (√) mark indicates test to be carried out and (X) mark indicates test need not to be carried out.
- iii) The power factors should not exceed 0.5% (at 20 °C). However, in case of deviation from limiting values the same shall be resolved in line with IEEE Std-62.

TECHNICAL REQUIREMENTS

- iv) (*) this test is applicable on Transformer neutral earthed thru NGR.
- v) Not used.
- vi) **During Infra-red thermography test of GT, the temperature of any part of tank shall be limited to 110 deg C.
- (vii) Not used.

1.11.04 **Not used.**

1.11.05 **TANK TESTS**

(a) Routine tests

(1) Oil leakage test on assembled transformers

All tank and oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature and applying pressure equal to the normal pressure plus 35 kN/m² measured at the base of the tank. The pressure shall be maintained for a period of not less than 6 (six) hours during which time no sweating shall occur. For GT this test shall be repeated as a pre-commissioning test at site for 24 hours.

(b) Type tests

(1) Vacuum test

Transformer tank shall be subjected to the specified vacuum. The tank designed for full vacuum shall be tested at an internal pressure of 3.33 kN/m² absolute (25 torr) for one hour. The permanent deflection of the plate after the vacuum has been released shall not exceed the values specified below:

Horizontal Length of Flat Plate (in mm)	Permanent deflection (in mm)
Up to and including 750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.5
2001 to 2250	11.0
2251 to 2500	12.5
2501 to 3000	16.0
Above 3000	19.0

(2) Pressure Test

Transformer tank shall be subjected to a pressure corresponding to twice the normal head of oil or to the normal pressure plus 35 kN/m² whichever is lower, measured at the base of the tank and maintained for one hour. The permanent deflection of the plates after the excess pressure has been released shall not exceed the figure specified above for vacuum test.

1.11.06 **NEUTRAL GROUNDING RESISTANCE (NGR) TESTING (as applicable)**

TECHNICAL REQUIREMENTS

(a.) The following routine tests shall be conducted on each resistor provided with transformer covered in this section.

- (1.) Ohmic value measurement (For resistance & reactance separately).
 - (2.) Insulation resistance measurement before & after HV test
 - (3.) HV test for 1 min. at a voltage corresponding to the insulation level of the resistor.
- (b.) DOP test on enclosure (routine test): It shall not be possible to insert a 2.5mm dia steel wire into the enclosure from any direction without using force.
- (c.) Short time current test along with temperature rise test (type test).
- (d.) Degree of protection test for IPX3 on enclosure (type test).

1.12.00 Commissioning Checks

Apart from general & prescribed commissioning checks following additional checks shall also be performed on GT: -

1. FRA Test
2. Core isolation test
3. DGA test

1.13.00 Initial Operation for Transformers

- a) Continuously observe the transformer operation at no load for 24 hrs. w.r.t. Voltage, no load current, temperature rise and noise.
- b) Gradually put the transformer on load, check and measure increase in temperature in relation to the load and check the operation with respect to temperature rise and noise level etc.
- c) For GT Infrared thermography shall be done after 12 hours of full load operation and results will be recorded for future reference.

1.14.00 Installation and movement of spare GT on site

The spare transformer shall be erected and prepared for long term storage as well as for the rapid transfer of this unit into a service position as approved by the Owner.

1.15.00 TRANSPORTATION

The contractor shall be responsible to select and verify the route, mode of transportation and make all necessary arrangement with the appropriate authorities for the transportation of the equipment. All metal blanking plates and covers which are specifically required to transport the transformer shall be considered part of the transformer and handed over to NTPC after completion of the erection. The total duration of storage at site with dry gas shall be limited to three (03) months after which transformer/reactor shall be processed and filled with oil.

TECHNICAL REQUIREMENTS

The scope of any necessary modification/ extension/ improvement to existing road, bridges, culverts etc. shall be included in the scope of the bidder.

NOTE:

Despite all condition monitoring done by the Owner, the Contractor shall be responsible to obtain all required inputs such as DGA to evaluate the Transformer. The guarantee and costs of any repair done under the guarantee shall not be affected by any condition monitoring done or not done by the Owner during the guarantee period. A full DGA test shall be completed at the end but before expiry of the guarantee period.

1.16.00 Not used.

2.00.00 NOT USED.

3.00.00 MAINTENANCE, TESTING & MONITORING EQUIPMENTS

1.	Not used.		
2.	Oil BDV Measurement kit.	Automatic oil testing unit for checking BDV of transformer oil upto 80kV.	1 No.
3.	Oil tan delta and resistivity measurement kit.	Suitable for measurement of Volume resistivity, Dielectric constant, Watt loss, loss factor with elevated temperature read out for transformer oil.	1 No.
4.	Dew point meas. instrument.		1 No.
5.	FRA Test Kit		1 No.
6.	Capacitance & Tan delta measurement Equipment (with cables etc.)	0-10kV (Fully Automatic)	1 No.
7.	Transformers turns ratio Kit	Display of ratio & phase angle deviation.	1 No.

TECHNICAL REQUIREMENTS

8.	Winding Resistance measurement kit		1 No.
9.	Off Line laboratory model oil DGA kit.		1 No.
10.	Hydraulic jacking system	Suitable for lifting / wheel rotation for heaviest oil filled Transformer.	1 No.
11.	On Line Moisture Removal System	GT	2 Set
12.	Not used.		
13.	Oil Purifying Equipment	1,000 Litres / hr.	1 No.
14.	Vacuum pump with motor, pipes & accessories	Free air displacement of 3040L/min, Ultimate pressure of 0.7PA & Blank off vacuum of 0.01torr.	1 No.
15.	Not used.		
16.	Oil tanker, wheel mounted, 5kL capacity	5kL Capacity	2 Nos.
17.	Not used.		

3.01.00 NOT USED

3.02.00 ON LINE MOISTURE REMOVAL SYSTEM

GT shall be equipped with "Online Moisture Removal System". However other GTs including spare GT shall have suitable provision so as to provide same at a later stage. The system shall be fitted in an enclosure. Oil Moisture measurement probe shall be provided with "Online Moisture Removal System". Alarm / status information shall be appropriately wired up to the M. box through for monitoring in SAS/DCS/plant control system.

3.03.00 FREQUENCY RESPONSE ANALYSER

3.03.01 TECHNICAL PARAMETERS

a)	Test Method	:	Sweep Frequency Response Analysis
b)	Frequency Range	:	10 Hz to 10 MHz
c)	Provision of selection of user defined frequency range within above frequency range.		

TECHNICAL REQUIREMENTS

d)	Accuracy	:	(+ /-)1 dB
e)	Operating Voltage	:	230 V, 50 Hz
f)	Built in self-calibration.		
g)	Equipment shall be able to display and plot frequency Vs magnitude and frequency Vs phase angle curves.		
h)	Equipment shall be complete in all respect with all-necessary cables, printer, Floppy/CD drive etc.		
i)	Suitable for use at 50 deg. C ambient temperature & 85% relative humidity.		
j)	The instruments & cable shall be designed to ensure repeatable measurement confirming to relevant international standard.		

3.03.02 GENERAL TECHNICAL REQUIREMENT FOR FRA

Employer intends to do condition assessment of transformers using the frequency response technique. The equipment should broadly consist of variable frequency voltage source, network analyzer, necessary software and cabling, Equipment shall be portable and shall be capable of onsite use.

3.04.00 HYDRAULIC JACKING SYSTEM

This shall be minimum four jack systems having motor operated synchronous operation suitable for lifting/wheel rotation of heaviest Oil filled power transformers in this package. System shall be complete in terms of piping, hydraulic system and associated auxiliaries.

3.05.00 CAPACITANCE & TAN DELTA MEASURING EQUIPMENT

3.05.01 Capacitance & tan delta measuring equipment (with cables etc.) (0-10 kV) (fully automatic) with necessary software, display arrangement & transportation accessory.

3.06.00 HIGH VACUUM TYPE OIL PURIFYING EQUIPMENT

3.06.01 TECHNICAL PARAMETERS

a) Capacity	1,000 litres/hr
b) Type	Weather proof mobile and outdoor type high vacuum oil filtration plant.
c) Processing temperature (direct heating of oil prohibited)	60 °C (max.)
d) Capability of plant on a single pass basis	
i) Removal of moisture	From 100 ppm to 3 ppm
ii) Removal of dissolved gas content	From 10% by vol. to 0.1% by Vol.
iii) Improvement of dielectric strength	From 20 kV to 70 kV
e) Filtration pore diameter	0.5 microns or less
f) Vacuum pumping system	Two independent vacuum pumping combination, one for degassing chamber and other for transformer oil evacuation and creating high vacuum in tank. The blank off vacuum of each pumping system shall be 10^{-3} torr or less.
g) Operating voltage	440/400 Volt, 50 Hz, 3 phase, 4 wire supply.

TECHNICAL REQUIREMENTS

3.07.00 OIL TAN DELTA AND RESISTIVITY MEASUREMENT KIT

- a) Suitable for measurement of Volume Resistivity, Di-electric constant, Watt loss, loss factor with elevated temperature read out for transformer oil.
- b) AC and DC voltage to be switched internally for tan delta and resistivity measurement respectively.
- c) The kit should be microprocessor based with display of test voltage and measured values.
- d) RS 232 computer interface and test report-printing facility.
- e) Oil cell and heating chamber to be supplied along with the test set.

3.08.00 OIL BDV MEASUREMENT KIT

- a) Automatic oil testing unit for checking BDV of Transformer oil up to 80kV.
- b) The kit should be suitable for laboratory use.
- c) The kit should be fully automatic with sequence control.
- d) Separate voltmeter for calibration of kit should be supplied.
- e) The results should be stored in memory for subsequent retrieval.
- f) Separate printer should be available for printing test results.
- g) The kit should be able to test oil as per BS5730, IEC156, ASTM test standard.
- h) Basic accuracy desirable is 3%.

3.09.00 TRANSFORMER TURNS RATIO (TTR) MEASUREMENT KIT

- a) Microprocessor controlled fully automatic test set.
- b) Automatic measurement and digital display of ratio, phase angle deviation.
- c) Automatic polarity indication.
- d) Light weight and portable.
- e) Three-phase ratio and excitation current meter.
- f) Automatic data storage of tests and reports generation.

3.10.00 VACUUM PUMP WITH MOTOR, PIPES & ACCESSORIES FOR EVACUATING VACCUM IN TRANSFORMER

3.10.01 Technical Parameters

- a) Free air displacement: Minimum 3000 L/min,
- b) Ultimate pressure : 0.7PA
- c) Blank off vacuum : 0.01 torr

3.11.00 DEW POINT MEASUREMENT INSTRUMENT

- a) Dew point range: -50°C to +20 °C
- b) Accuracy : $\pm 3^{\circ}\text{C}$
- c) Operating Temperature range: 0°C to +50 °C
- d) Data storage & transfer facility via RS 232/ Equivalent port
- e) Instrument & probe shall be supplied along with casing.

TECHNICAL REQUIREMENTS

3.12.00 WINDING RESISTANCE MEASUREMENT KIT

1. Microprocessor controlled fully automatic operation.
2. Wide range of test current (minimum current of 50A).
3. Suitable for operation in EHV Switchyard condition.
4. Protection circuit for suppression of induced voltage kickback.
5. Display of resistance vs time curve.
6. Computer and printer interface.
7. Lightweight and portable.
8. The kit should safely dissipate the energy stored in the transformer after test.

3.13.00 OFF LINE LABORATORY MODEL OIL DGA KIT

3.13.01 Power supply : 240 V \pm 15% , 50Hz \pm 5%,AC, Single Phase

3.13.02 Compatibility : IEC-60567/ASTM D 3612 Method-C (with auto-sampler)

3.13.03 Main Frame : Complete with gas extraction, injection port; column, oven, TCD-Detector, gas flow regulation, measurement system & related electronics, PC with latest configuration, Color Monitor, Printer.

(a.) Injection System:

Dual column injection system with provision for introducing sample range from 1 to 5 ml. The sample volume must be reproducible such that successive runs agree within 1 mm or 1% (which ever is larger) on each component peak height.

(b.) Injection Temp:

50°C to 400°C in 1 °C increment.

(c.) Drier :

Ahead of sample inlet to remove complete moisture with removal of components.

(d.) Oven :

Should have sufficient space to house the analytical columns & reference columns. The oven shall be equipped with precise temperature control and measurement system to maintain the columns within \pm 1°C of the specified temperatures even during temperature programmed runs. The oven should be capable of maintaining temperatures 10°C above ambient to 400°C.

It should have also the following features:

(e.) Column over heat protection: user can set up to 400°C.

(f.) Temperature Programmer: Rate from 1°C to 45 °C/min. 3 ramps with initial and final holds.

(g.) Automatic cooling under process control.

(h.) 6 port valve: A six way flanged PTFE of equivalent plug to permit the use of either the absorption or partition column and for reversing the carrier flow and another six port valve for gas sampling.

Note: Any other valve configuration depending upon the types of columns configuration

TECHNICAL REQUIREMENTS

offered may also be supplied.

(i.) Columns :

10 ft x 1/8" Poropak N (80/100 mesh)
3 ft x 1/8" Molecular sieve 13 x (45/60 mesh)

(j.) Detection Limits

H2	10 PPM
C2H4,C2H6,C2H2,C3's	1 PPM
CO2, CO	25 PPM

Note: Any other column configuration suitable for the complete analysis of the transformer oil may be supplied.

(k.) Detector: Thermal conductivity detector or equivalent in range, sensitivity and stability.

(l.) TCD : It should have the following features :

- (1.) Operating temp. : 100°C to 350°C in 1 °C increment.
- (2.) Linearity: above 105 range

(m.) Carrier gas flow system: The equipment shall be equipped with EPC to provide a flow of carrier gas through columns at a flow that is constant to 1% throughout even during temperature programming.

(n.) Auto Sampler: System shall be able to extract gas automatically and transfer to GC unit.

3.13.04 The equipment shall be equipped with dual flow, dual column system. The inlet pressure and flow rate of the carrier gas should be controlled by electro pneumatic control as well as through data processor with digital and screen display of the pressure and the flow rates.

3.13.05 Equipment should have provision of operation with PC (with latest configuration) with Interface IEEE 488-GPIB or RS 232 c Serial Interface of LAN card. The computer should be with latest configuration having Deskjet Colour Printer with IFT Colour Monitor.

3.13.06 Software : The system should have the current windows based software with function of calibration, recalibration, Data storage, re-slope, display of recommended condition.

3.13.07 Accessories: All other accessories required for independent operation of the equipment.

- i. Operation Manual
- ii. Service Manual

iii. For routine maintenance of the equipment other requirements :

- The equipment must be installed/commissioned and also demonstrated for all features specified by the supplier/their authorized agent.

3.13.08 1 no. of oil sampling vessel shall be provided.

3.13.09 Certified Calibration gas standard(for calibration of gas Chromatograph)

Composition:	
H2	100 PPM

TECHNICAL REQUIREMENTS

CH4	100 PPM
CO	100 PPM
CO2	1000 PPM
Ethylene	100 PPM
Ethane	100 PPM
Acetylene	10 PPM
Propane	100 PPM
Propylene	100 PPM
To be supplied in 3 liter water capacity carbon steel or aluminum cylinder filling pressure:	120 Kg/Cm ² (approximately) or 0.5 liters aluminium container, 20 Kg/Cm ²
Stability	The standard supplied should have at least 1 Year stability
Certificate	The standard should carry a certificate which is should be traceable to NIST standard.
Preparation Tolerance	±20%
Certification Accuracy	±2%

3.14.00 OIL TANKER, WHEEL MOUNTED, 5 KL CAPACITY

3.14.01 The tanker manufacturing shall be as per BS-2594.

3.14.02 The oil tanker shall be capable of withstanding vacuum of 10mbar and 0.4kg/cm² pressure.

3.14.03 Painting Requirements

PARTS NAME	TYPE OF PAINT	NO.OF COATS	TOTAL DFT
Inside of tank	Oil & heat resistant fully glossy white	One coat	Atleast 30 micron
External surface of Tank	Chemical resistant epoxy zinc phosphate primer, MIO (Micaceous iron oxide) as intermediate paint followed by polyurethane finish paint (RAL 5012 Blue)	One coat each	Atleast 100 micron

3.14.04 Four numbers of gate valve shall be provided on one pair of opposite sides of the tank attached on top & bottom of the tank.

3.14.05 Oil level gauge is to be provided on the tank to see the level of oil.

3.14.06 The tanker is to be mounted on tubeless wheeled platform for easy movement.

3.14.07 Suitable arrangement for hauling the tanker in either forward/reverse direction is to be provided.

3.14.08 Circular manhole is to be provided at middle of the roof of the tanker.

3.14.09 Provision for Nitrogen filling to be provided along with nitrogen pressure gauge for measuring upto 1kg with least count of 0.01.

3.14.10 Indicating Type Cobalt free silica gel breather (transparent body) shall be provided.

3.15.00 NOT USED.

TECHNICAL REQUIREMENTS

**Standard Terminal Numbers to be incorporated in Transformer Marshalling Box
For Outdoor Transformers (Oil filled)**

Terminal No.	Description
T-01	230V, Single Phase, 50Hz, AC Supply
T-02	
T-03	
T-04	
T-05	MOG (Oil Level) Alarm
T-06	
T-07	Buchholz Relay Alarm
T-08	
T-09	
T-10	OTI Alarm
T-11	WTI-1 Alarm
T-12	
T-13	WTI-2 Alarm
T-14	
T-15	PRV-1 Alarm
T-16	
T-17	PRV-2 Alarm
T-18	
T-19	
T-20	Buchholz Relay Trip
T-21	
DUMMY	
T-22	PRV-1 Trip
T-23	
DUMMY	PRV-2 Trip
T-24	
T-25	
DUMMY	OTI Trip
T-26	
T-27	WTI-1 Trip
DUMMY	
T-28	
T-29	WTI-2 Trip
DUMMY	
T-30	Neutral CT (for REF Protection) 64
T-31	
DUMMY	
T-32	
T-33	Neutral CT (for Earth Fault Protection) 51N
T-34	
T-35	
T-36	CT Shorting Terminal
T-37	
T-38	CT Shorting Terminal
T-39	
T-40	Spare Terminals for NTPC use
T-41	
T-42	
T-43	
T-44	
T-45	220V DC Supply (If required)
T-46	

Notes:

1. The Terminals from T-01 to T-46 shall be designated as indicated in the chart for all outdoor auxiliary transformers (upto 16MVA)

2. The Terminals which are not used for a particular Transformer shall be left as spare. e.g. in case there is only one PRV, then terminals T-17, T-18, T-25 & T-26 shall be left as spare terminals.

Drg. Title	Standard Terminal Numbers for Marshalling Box of oil filled transformers		
Drg. No.	0000-203-PVE-B-001		

PART-B
VOLUME – II
CHAPTER – II-E14
PROTECTION AND METERING SYSTEM

TECHNICAL REQUIREMENTS

CONTROL AND PROTECTION

1.00.00 GENERAL REQUIREMENTS FOR PROTECTIONS

Relays/Energy meters shall be flush mounted on the front with connections at the rear; shall be draw out or plug-in type/modular case with proper testing facilities. Provision shall be made for easy isolation of trip circuits for testing and maintenance.

2.00.00 OPERATIONAL REQUIREMENTS FOR NUMERICAL RELAYS AND AUXILIARY RELAYS

2.01.00 All protection relays to be supplied under this package shall be of Numerical type.

2.02.00 All numerical relays, auxiliary relays and devices shall be of latest version, reputed make and types proven for the application, satisfying requirement covered elsewhere and shall be subject to Owner's approval. Relays and timers shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity to the satisfaction of the Owner.

2.03.00 Numerical relays shall be suitable for efficient and reliable operation of the protection scheme. Necessary auxiliary relays, timers, trip relays, etc. required for complete scheme, interlocking, alarm, logging, etc. shall be provided. No control relay, which shall trip the circuit breaker when relay is de-energized, shall be employed in the circuits.

2.04.00 Relays shall be provided with self-reset contacts except for the trip lockout relays, which shall have manual reset facility. Suitable measures shall be provided to ensure that transients present in CT & VT connections due to extraneous sources in EHV system do not cause damage to the numerical and other relays. CT saturation shall not cause mal-operation of numerical relays.

2.05.00 Except for event logging, alarm and annunciation type of non-trip functions, protective relay contact multiplier relay shall be high speed trip relay only.

2.06.00 Only DC/DC converters shall be provided in the solid state devices / numerical relays wherever necessary to provide a stable auxiliary supply for relay operation. DC batteries in protective relays and timers necessary for relay operation shall not be acceptable. Equipment shall be protected against voltage spikes in auxiliary DC supply.

2.07.00 The numerical protection shall have continuous self-monitoring & cyclical test facilities. The internal clock of all the numerical relays being supplied under this package shall be synchronized through the GPS Time Synchronizing System to be supplied under this contract. A timing accuracy of 1ms shall be achieved for all the numerical relays.

2.08.00 Each numerical relay shall have a serial interface on the front for local communication through PC & Printer. Further, all the numerical relays being supplied under this package, shall be interconnected to each other through a rear communication port, forming an engineering LAN, connected to engineering workstations located in the main plant control room (CCR). Facilities shall be provided to access each discrete protection function including modification in the relay settings and monitoring of the relays through local HMI and engineering workstations located on the operators table in the CCR. Necessary licensed software (latest version) and hardware including PC (latest configuration), printer, fiber optic cable cabling (fiber optic cable to be used if the distance is more than 100 meters) and furniture one set each for CCR, for the above purpose shall be in the scope of the bidder. A print out of all settings, scheme logic, event and disturbance records etc. shall be accessible through HMI and the engineering workstations. Display of various measured parameters during normal as well as fault condition on segregated phase basis shall be provided. In addition to local HMI, Numerical relays shall also have LEDs and back lit LCD screen shall be provided for visual indication and display of messages related to major trips / alarms generated in the relays. Necessary multilevel password protection shall be provided.

TECHNICAL REQUIREMENTS

- 2.09.00** The sampling rate of analog inputs, the processing speed and processing cycle of digital values shall be selected so as to achieve the operating times of various protection functions specified. In case Bidder does not have all the protections specified, as a part of the standard numerical relay, separate discreet numerical relays can be provided for such protection. The reasons for providing the same shall be clearly brought out in the bid.
- 2.10.00** The communication protocol for all numerical relays supplied under this package shall be IEC61850.
- 2.11.00** The protection system shall be arranged to provide two independent, high performance and reliable systems with separate monitored DC supplies, separate CT/VT cores, separate cables and trip relays to obtain 100% redundancy. Associated trip relays of the two systems shall be separate, having sufficient number of contacts for all the functions. Each protection shall energize both trip coils of the circuit breakers to be tripped.
- 2.12.00** The numerical relays shall be provided with built-in disturbance recorder. The data from DR function shall be available in IEEE/COMTRADE format and compatible with the dynamic relay test system being supplied in this contract.
- 2.13.00** The manufacturer of the offered numerical protection system shall carry out complete engineering, testing & commissioning at site of the offered protections including the associated relay & protection panels.
- 2.14.00** The numerical relays offered shall have self-diagnostic features to reduce the down time of the relay and provide useful diagnostic information on detection of an internal fault to speed up the maintenance. Necessary support documentation explaining the self-diagnostic features of the numerical relays in detail shall be furnished for owner's use.
- 2.15.00** The total critical fault clearance time from fault initiation in any part of the system shall be 160 m sec for phase to phase fault in the generator-transformer unit and for phase to phase and phase to earth faults in the HV system inter-connection.

3.00.00 Interface with Main Plant DCS

Control of circuit breakers shall be carried out from main plant DDCMIS through hardwired control commands in the form of 24V DC signal. Necessary coupling relays, as applicable, shall be provided. The control hierarchy shall be built with equipment level as top priority followed by BCU level and DDCMIS as the last priority. Suitable hardware and software including gateway and LAN switch shall be provided to interface the engineering LAN described above with OPC compliant DCS. The interface shall be redundant and shall enable data exchange between the engineering LAN and owner's DCS. The exact signals shall be finalized during detailed engineering. (Note: The I/O list for above shall be made available to the Bidder during detailed engineering). The cable and associated hardware required for connecting SAS network to the plant DDC terminal shall also be provided by the contractor.

4.00.00 Bay Level Functionality

- i. All the Bay Level Functionality shall be built into Bay Control Units (BCUs) and Bay Protection Units (BPUs).
- ii. BCUs and Bay Protection Units shall be provided at Control Level 1 i.e. Bay Level of Logical Architecture, to facilitate control, monitoring and protection of switchyard equipment. One Bay Control Unit shall provide complete functionality for one HV bay. Each set of BCUs shall have sufficient analog and digital inputs to acquire the status of each and every circuit breaker, isolator, earth switch, Transformer gas parameters / tap position etc. of all the bays in Contractor's scope. **A minimum of 64 Digital Inputs and 24 Digital Outputs per bay** shall be provided in

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associated_Bay Control Units. A minimum number of **16 Analogue input** channels per bay shall also be provided in the associated BCU. Rating of the various analogue input channels (110 V /1 A /4-20 mA) shall be decided during detail engineering.

- iii. All the Bay Control Units and Bay Protection Units at Plant end shall be installed in GIS control room in SWITCHYARD. BCU & BPU shall be mounted in the same panels. The protection relays for Generators shall be located in respective power station control equipment rooms.
- iv. All BCUs and Bay Protection Units shall be provided with self-diagnosis and supervision functions to ensure maximum availability. BCUs shall require no periodic routine maintenance and testing. An alarm contact shall be provided for hardware failures, failures of internal and external auxiliary supplies etc. Special algorithms shall be provided to check the microprocessor's memories. A watchdog function shall supervise the execution of program by the microprocessor.
- v. The layout of equipment/panel in SWITCHYARD GIS control Room shall be subject to Owner's approval.

Bay Control Units (BCU)

5.0 Control and Protection Features of BCUs

The Bay Control Units shall have following built-in functions:

- i. **Mimic control panel** to display graphically the bay configuration, status of the plant, analogue measurands, alarms, and offer bay level control.
- ii. **Switching of Switchyard Bay Equipment** depending on conditions such as interlocking, synch-check, control mode, or external status condition. Adequate safety features like prevention of double operation, command supervision, block/de-block, over-riding the interlocking etc. shall be provided. All such security features shall be finalized and approved by Owner during detailed engineering.
- iii. **Status Supervision** of switchyard equipment
- iv. **Interlocking Function** to prevent unsafe operation of switchyard equipment such as circuit breakers, isolators, earth switches etc. Interlocking shall be implemented on bay level, by user-friendly, menu-driven configuration software within the BCU, Interlocking shall operate independent from the Substation Controller. Signaling of statuses between bays shall be performed by inter-bay communication (peer-to-peer) i.e. Goose messaging. The auxiliary contacts of each of the equipment shall be wired to the BCU for this purpose. However for those equipment, which are required for interlock of other bay equipment, two sets of their contacts shall be wired to BCUs of two different bays. Such interlocks involving more than one bay equipment shall be realized through goose messaging. An over-riding / bypass function for bay-level interlocking shall be provided at appropriate security level for maintenance or during emergency conditions. Failure of any one BCU shall not affect the interlocking at any other bay, only the bay with failed BCU shall not be able to operate. This shall be achieved by providing a backup mechanism in case of failure of one BCU which affects the interlocking in another BCU (e.g. a backup mechanism for monitoring the status of the bus bar earths), to allow the remainder BCUs to function **with full interlocking**. The interlocking logic shall be defined during the details engineering phase to prevent illegal operation.

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- v. **Analogue Measurements** for bay voltage (per phase), current (per phase), frequency, MW and MVAR, tap position / gas parameters / winding temperature of Transformers. These measurements shall not require the use of any intermediate transducers. The accuracy of measurement shall be 0.5% for voltage, current and frequency, and 1.0% for MW and MVAR. The measured and computed values shall be displayed locally on BCU and on operator's workstation located in central control room.
- vi. **Event and Alarm Handling:** BCUs shall acquire all the bay level alarms and events from field inputs with a resolution and time tagging of 1 milli sec and shall transfer these to operator's workstation over substation LAN.
- vii. **Synchronization Check Feature:** Synchronization Check feature shall determine the difference between the amplitudes, phase angles and frequencies of two voltage vectors. Checks shall be provided to detect a dead line or bus bar. The voltage difference and phase angle difference settings shall be adjustable

5.1 Bay Protection Units

5.1.0 General

- a) Trip commands from Bay Protection Units shall be hard-wired directly to appropriate switchyard equipment. The interlocking information to be hard-wired between Bay Protection Units and Bay Control Units shall be decided by Owner during detailed engineering stage.
- b) Bay Protection Units for Main Generator Circuits shall be as described in **clause 5.2.**
- c) The interface of Bay Protection Unit for HV lines with PLCC/communication panels shall be in contractor's scope.
- d) Relay parameterization for SWYD/ GRP relays shall be possible from the respective EWS.

5.1.1 General Requirements of Numerical Relays and Auxiliary Relays

- a) All numerical relays, auxiliary relays and devices comprising the Bay Protection Units shall be of types, proven for the application, satisfying the requirements specified elsewhere and shall be subject to the Owner's approval.
- b) The necessary auxiliary relays, trip relays, etc. required for complete scheme, interlocking, alarm, logging, etc. shall be provided. No control relay, which shall trip the circuit breaker when the relay is de-energized, shall be employed in the circuits.
- c) Relays shall be provided with self-reset contacts except for the trip lockout, which shall have contacts with a manual reset feature. Manual resetting shall be possible from Control Level 2 as well as Control Level 1 with suitable authorization.
- d) Transients present in CT & VT connections due to extraneous sources in the EHV system shall not cause damage to the numerical and other relays. CT saturation/ transients shall not cause mal-operation of numerical relays.
- e) Only DC/DC converters shall be provided in the solid state devices / numerical relays wherever necessary to provide a stable auxiliary supply for relay operation. Except for event logging, alarm and annunciation type of non trip functions, protective relay contact multiplication shall be done through high speed trip relay only.
- f) DC batteries inside protective relays necessary for relay operation shall not be acceptable. Equipment shall be protected against voltage spikes in the auxiliary DC supply.

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g) Each numerical relay shall have a serial interface on the front for local communication to a Personal Computer and Printer. Additionally, facilities shall be provided to access each discrete protection function including modification in relay settings and monitoring of the relay from a HMI or a separate Protection / Disturbance Recorder Station provided and permanently wired to all the numerical relays comprising various Bay Protection Units, as shown in NTPC tender drawing. For numerical relays of switchyard, the HMI shall be located in SWYD control room at the Substation Level and for those in GRP, dedicated engineering /DR work station has to be provided in CER -1. A print out of all settings, scheme logic, event records etc. shall be accessible through the HMI. The display of various measured parameters during normal as well as fault conditions on a segregated phase basis shall be provided. LEDs and a backlit LCD screen shall be provided for visual indication and display of messages related to major trips / alarms. Necessary multilevel password protection shall be provided.

h) The Bay Protection Units shall be arranged to provide two independent, high performance and reliable systems housed in different panels with separate DC supplies, separate CT/VT cores, separate cables and trip relays to obtain 100% redundancy. Associated trip relays of the two systems shall be separate, having a sufficient number of contacts for all the functions.

i) The numerical relays shall be provided with built-in disturbance recording functionality. The data from DR function shall be available in IEEE/COMTRADE format and shall be compatible with the dynamic relay test system being supplied under this contract.

j) The manufacturer of the numerical protection system offered shall carry out the complete engineering, testing and commissioning on site of the offered protection equipment including the associated relays and protection panels. The testing and commissioning protocols for the numerical protection systems offered shall be approved by the Owner before commissioning on site.

k) Pick up range of the Binary inputs shall be minimum 70 V DC/AC.

l) All the numerical relays shall have adequate processor capability to carry out programmable scheme logics (PSL) required for implementing approved protection and control schemes over and above its inbuilt protection functions algorithm.

m) All numerical relays shall be supplied with all the protection function/features in disabled condition. Relevant features/protection function shall be enabled at the time of commissioning at site as per approved logic and relay settings.

n) BPU offered shall have adequate I/Os for function realization. Use of auxiliary relays (contact multiplication) shall be permitted only when the entire product range does not support any further hardware augmentation for additional I/Os.

o) Configuration/ scheme logics /relay settings shall be submitted by the Contractor for approval during detailed engineering.

5.2 PROTECTION & METERING FOR MAIN GENERATOR CIRCUIT

For each Generator Transformer Unit (Generator with associated Generator transformer and unit transformer) protection, Numerical Protection system in line with clause 2.00.00 above shall be provided, to achieve comprehensive protection for the generator transformer unit for all types of faults and abnormal operating conditions.

5.2.1 The Generator-Transformer unit protection requirements specified above shall be configured into **two independent Numerical Protection Systems** each consisting of individual input transformation (aux CT/VT) modules, filters, processing units (CPUs), A/D & D/A converters, DC supply modules (DC/DC

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converters) etc. such that one numerical protection system shall be always available to detect and operate for any type of fault in the Generator-transformer unit, under condition of failure of the other numerical protection system AND/OR on failure of the associated DC supply systems of other numerical protection system. **Group II of Generator protection shall be on a different hardware platform than Group I protection. Protection function of two different equipment shall not be clubbed.** The individual protection systems shall be connected to independent set of hand re-set trip relays. Trip circuit supervision shall be provided for continuous monitoring of trip relays, trip circuit and associated trip coils and the discontinuity shall be annunciated in CCR / SCR as applicable. Further, the system shall have facilities to accept digital input signals of various alarm and trip conditions of the Generator transformer and unit transformer with complete galvanic separation. Further, all interface and coordination requirements with the control, interlock and protection schemes provided for the switchyard shall be achieved.

5.2.2 The alarm/status of each individual protection function and trip operation shall be communicated to main plant DDCMIS. The numerical protection system shall have built-in features, hardware / software interface to provide such inputs to DAS for analog/digital values.

5.2.3 **The Numerical Generator Protection System shall comprise the protections indicated in the following table, which also contains the preferred grouping of various protections:**

S. No.	Protection Function	Grouping of Protection Functions
1.	Generator Differential Protection, (87G1/87G2)	87G and 87GT shall be on two different channels of protection.
2.	Overall Differential Protection (87GT)	
3.	Generator Transformer Differential protection (87T)	87T shall be in a different channel than 87GT
4.	Over Hang Differential Protection (87HV)	87 HV shall be in a different channel than 87T.
5.	Stator Earth Fault Protection covering 100% of winding (64G1) based on injection principle.	64 G1 and 64 G2 shall be on two different channels of protection.
6.	Stator Standby Earth Fault Protection covering 95% of winding (trip) (64 G2)	
7.	Inter-turn Fault Protection (95G)	
8.	Duplicated Loss of field protection (40G1/2)	40G1 and 40G2 shall be on two different channels of protection.
9.	Back up Impedance Protection, 3 pole (21G1/2) or 51V	
10.	Backup Earth Fault Protection on Generator Transformer HV neutral (51NGT)	
11.	Negative Sequence Current Protection, (46G1/2)	
12.	Duplicated Low-Forward Power / Reverse power Interlock for steam turbine generator (37/32G1 & 37/32 G2), each having following two stages. Short time delayed interlocked with turbine trip (0-10 sec)	37/32 G1 and 37/32 G2 shall be in two different channels of protection.

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	b) Long time delayed independent of turbine trip (0-60 sec)	
13.	Two Stage Rotor Earth Fault Protection (64F) based on injection principle. The relay should be capable of monitoring the healthiness of injection circuit and raising an alarm in case of open discontinuity in injection circuit.	Setting Range for Rotor E/F Protection (Alarm/Trip) – 1KΩ to 50KΩ
14.	Definite Time Delayed Over-Voltage Protection (59G)	
15.	Generator Under Frequency Protection (81G) with df/dt elements	
16.	Over Fluxing Protection for Generator (99G) & Generator Transformer (99T)	
17.	Accidental Back Energisation protection (50GDM) on two principles a) based on U/V and O/C b) based on CB status and O/C	50 GDM based on the two principle shall be on two different channels.
18.	Duplicated Generator Pole slipping protection(98G)	
19.	LBB protection for GCB	
20.	E/F Protection for GT LV / UT HV Wdg (64GTLV)	
21.	Unit Transformer Differential Protection, 3 pole (87UT)	
22.	Unit Transformer LV back-up earth fault protection (51NUT)	87 UT & 51 NUT should be in one channel and 64 UT LV & 51UT shall be in another channel.
23.	Unit Transformer LV REF (64 UT LV)	
24.	Unit Transformer back-up over current protection (50/51UT)	
25.	Gen Transformer OTI/WTI trip	OTI & WTI trip shall be on different channels
26.	Gen Transformer Buchholz / PRV / other mechanical Protections	
27.	Unit Transformer OTI/WTI trip	OTI & WTI trip shall be on different channels
28.	Unit Transformer Buchholtz, PRV /other mechanical Protections	
29.	Alarm for all cooler /OLTC trouble for GT/UT as applicable.	
30.	Following general functions shall also be provided a) VT fuse failure relay b) Trip relays as required c) Trip circuit supervision / trip relay / DC supervision	

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6.00.00 Relays / Transducers for Owner's Use

Following transducers shall be provided in the generator relay panel for owner's use:

i) 33 kV Bus 1 voltage		4-20mA 0-36kV
ii) 33 kV Bus 2 voltage		4-20mA 0-36kV
iii) Generator Current	R phase	4-20 mA 0-2kA
iv) Generator Current	Y phase	4-20 mA 0-2kA
v) Generator Current	B phase	4-20 mA 0-2kA
vi) Generator voltage (R-Y)		4-20mA 0-12kV
vii) Generator voltage (Y-B)		4-20mA 0-12kV
viii) Generator voltage (B-R)		4-20mA 0-12Kv
ix) Generator frequency		4-20 mA 45-55Hz
x) Generator power factor		4-20 mA 0.5 lead -0.5 lag
xi) Generator Active Power		4-20 mA 0-40 MW
xii) Generator Reactive Power		4-20 mA

7.00.0 METERING

The following integrating meters shall be provided in the generator circuit:

- a) ABT meter for generator circuit and each LV incomer of Unit Transformer
- b) Meter shall be as per the requirements outlined in **clause 12**. These meters will be located in Generator Relay Panel

8.00.00 HV Feeder Protection

i. Each 33kV Feeder shall be provided with the following protection:

Main-I : Numerical directional overcurrent and Earth fault protection

Main-II : Numerical directional overcurrent and Earth fault protection .

The Main-I and Main-II protection shall be of equal performance capability.

The Main-I and Main-II protection relays shall be connected to two different protection groups to meet the requirements of relevant clause above.

The protection and control equipment and circuitry, shall be arranged to provide two independent, high performance and reliable protection systems with separate DC supplies, separate CT/VT cores and separate cables and self reset (single phase) hand reset (three phase) trip relays to obtain 100% reliability. The DC supplies to these protections shall be monitored.

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Associated trip relays of the two systems shall be separate having sufficient number of contacts for all the functions.

Each protection system shall energize both trip coils of the circuit breaker. The SIR values to be considered for operating time of relays shall be between 4 to 15. Rated break time for HV breaker as offered shall be considered for the purpose of operating time. Bidder shall furnish the operating time curves at various SIR values for all types of faults.

9.01.00 DISTURBANCE RECORDER

The numerical relays, provided for each feeder under this package shall have built in disturbance recording function. The built in DR function shall meet the requirements of digital fault and disturbance system given below. Disturbance Recording System provided shall meet the following requirements:

- a) Shall be used to record the graphic form of the instantaneous values of analog inputs such as voltages and currents in all the three phases, open delta voltage and neutral current in the primary circuits in the case of a short circuit (fault) and a disturbance in the Power System, as per the required technical parameters.
- b) Shall be provided with a self-monitoring facility.
- c) Fault / disturbance logs shall be clearly identified by Fault ID, Fault date and time (hour, minutes, seconds and ms). Time stampings on fault records shall be synchronized with a GPS clock.
- d) The disturbance recorder shall comprise distributed individual acquisition units, one for each feeder and an evaluation unit which is common for the entire substation. The acquisition units shall acquire the disturbance data for the pre-fault, fault and post-fault periods and transfer them to the evaluation unit automatically for storage on a mass storage device. The acquisition unit shall be suitable for inputs from current transformers with 1 A rated secondary and capacitive voltage transformers with 63.5 V (phase-to-neutral voltage) rated secondary.
- e) Shall have Scan rate of 1000 Hz or better for sampling each of the analog channels having a fundamental frequency of 50 HZ. The frequency response for these channels shall be DC on the lower side to 500 HZ or better on the upper side. Any interposing devices provided with the DFR system shall not compromise this frequency response.
- f) Shall be provided with sensors based on threshold values of voltage, current and frequency and rate of change of system frequency. External signals if required can also be used for triggering the DR. The starting sensors of the DFR, and pick-up, shall preserve the disturbance/fault data on the non-volatile solid state memory of the acquisition unit. The setting of the starting sensors shall be flexible, and shall have reasonable range/steps. The settings of the starting sensors shall be field programmable.
- g) The fault data from the Digital Fault Recording feature shall be available in IEEE / COMTRADE format. The data format shall be compatible for dynamic protection relay testing with the relay test kit to be supplied by the Bidder. The necessary equipment for interfacing and transfer of data shall also be supplied by the Bidder.
- h) All the fault records shall be transferred to the Protection / DR Station automatically or on request for further detailed analysis. The software for analyzing the fault data shall be available at the Protection / DR Station. The software shall be capable of the complete analysis of fault data, including the display of RMS/Peak envelop of any voltage / current, fundamental power frequency deviation, display of instantaneous values of Real Power (computed value), Reactive Power (computed value), power factor angle etc. A facility to edit the fault data shall also be provided.

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- i) Following analog values shall be recorded –
Currents (R-phase, Y-phase, B-phase and Neutral), Voltages (V_{RY} , V_{YB} , V_{BR} , Open Delta).
- j) The pre-fault recording time shall be at least 200 ms and the post-fault recording time shall be at least 5.0secs.
- k) It shall have:
 - 8 Analogue channels (I_R , I_Y , I_B , I_N , V_{RY} , V_{YB} , V_{BR} and Open Delta)
 - 16 Digital Channels
 - Amplitude Resolution of Analogue channels (minimum): 16 bit
 - Event Resolution of Digital Channel (minimum): 1 ms
 - Aux. voltage: 220VDC (+10%,-20%)

9.02.00 Auto-Reclose and Synchronizing Check

Auto-reclose (AR) and Synchronizing Check (SC) functionality shall be provided in a separate device i.e other than protection relay. The interfacing between BCUs and Bay Protection Units for achieving the AR function logic shall be achieved using hard-wired logic between BCU and Bay Protection Units. The AR function shall meet the following criteria:

- a) Be of single shot type
- b) Have three phase Reclosing facilities. It shall have a user-selectable option of single phase, three phase, single & three phase Reclosing or non-auto reclosure mode.
- c) Incorporate a normal/delayed auto reclosure option with a time range of 1 to 60 s.
- d) Have a continuously variable three-phase and single-phase dead time of 0.1 to 5 s.
- e) Have a continuously variable reclaim time of 5 to 300 s.
- f) Be properly configured for the breaker-and-a-half arrangement, permitting sequential closing of breakers.
- g) Incorporate the necessary auxiliary relays and timers to provide a comprehensive reclosing and synchronizing scheme.
- h) Have facilities for selecting check synchronizing or dead line charging features. The user shall have an option to change the required feature.

The built-in Synchronization Check feature shall determine the difference between the amplitudes, phase angles and frequencies of two voltage vectors. Checks shall be provided to detect a dead line or bus bar. The voltage difference, phase angle difference and slip frequency settings shall be adjustable.

9.03.0 Transformer Protection

- a) The Bay Protection Unit offered for each transformer should be such that it provides a comprehensive protection for the transformer for all types of faults

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and abnormal operating conditions.

- b) The numerical relays, comprising the Bay Protection Unit, for each transformer shall be configured into two protection groups operating on two separate DC supplies, such that one protection group shall always be available to detect and operate for any type of fault in the transformer/ Reactor, under condition of failure of other protection group or of associated DC supply of the other protection group.
- c) Should the protection functions specified for a transformer be available as a single discrete numerical relay, two such relays shall be supplied to meet the requirements of relevant clause above. Differential, REF and Back-up protection of any transformer/shunt reactor shall be realized in separate numerical relays with Differential, Back-up E/F in one channel and REF, Back-up O/C in another channel.

9.03.01 Transformer differential protection shall:

- a) be of numerical type and shall have continuous self-monitoring and diagnostic features
- b) be three-pole type, with faulty phase identification/indication. The operating time of the relay shall not be greater than 30ms at 5 times the setting.
- c) be stable for magnetizing inrush currents and shall be stable under normal over-fluxing conditions. Magnetizing inrush stability shall not be achieved through the use of an intentional time delay;
- d) have an internal feature in the relay to take care of the angle and ratio correction;
- e) have a disturbance recording feature to record the analogue form of instantaneous values of the current in all three windings (i.e. nine analog channels) during faults and disturbances for the pre-fault and post-fault periods. The disturbance recorder shall have the facility to record the following external digital channel signals in addition to the digital signals pertaining to the differential relay itself:
 - HV breaker (main and tie) status
 - LV breaker status
 - Buchholtz/On-load tap-changer Buchholtz alarm/trip
 - Winding temperature/Oil temperature/Pressure relief alarm/trip of transformer
- f) The necessary hardware and software for downloading the data captured by the disturbance recording function to a personal computer available in the substation shall be included in the scope.
- g) be acceptable with built-in features of definite time overload protection (alarm) relay provided the technical requirements of these relays specified under the relevant clauses are met.

9.03.02 Restricted Earth Fault Protection shall:

- a) be single-pole type;
- b) be of current/voltage operated high impedance type;
- c) have a suitable non-linear resistor to limit the peak voltage
- d) shall have setting range from 5-80%

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9.03.03 Transformer over fluxing Protection shall

- a) Operate on the principle of voltage to frequency ratio
- b) Have inverse time characteristics compatible to transformer over fluxing withstand capability and also a separate high set feature.
- c) Provide an independent alarm with continuously adjustable time delay.
- d) Tripping time shall be governed by V/F Vs time characteristic of the relay
- e) Have a set of characteristics for various multiplier settings.
- f) Have a resetting ratio of 98% or better.

9.03.04 Transformer Backup Over current Protection (51) shall

- a) Be triple pole type
- b) Be of definite time over current type
- c) Have an adjustable setting range of 20-80% or 150-600% of rated current (as applicable) and 0.3 to 3.0 sec time delay.
- d) Be provided with operation indicator

9.03.05 Transformer Backup Earth Fault Protection (51N) shall

- a) Be single pole type
- b) Be of definite time over current type
- c) have an adjustable setting range of 10-80% of rated current as applicable and 0.3 to 3.0 sec. Time delay
- d) Be provided with operation indicator

10.0.0 HV Circuit-breaker Protection

Each circuit breaker in the HV switchyard shall be provided with following protection functions:

- i) **Numerical Local Breaker Back up Protection Function:** Duplicated LBB protection function shall be provided for each EHV circuit breaker in the EHV switchyard. The LBB protection function for each main circuit-breaker shall be interfaced with the Bus bar protection by hard-wired signals between the Bay Protection Unit and the Bus bar protection panels. The intent of providing the hard-wired logic as a back up to the software logic is to ensure that in the event of failure of Substation LAN, the bay level functionality is not hampered. The LBB function as a built-in function of Bay Protection Unit is acceptable provided it meets all the requirements specified for the LBB function. However, Tie LBB of incomplete dia shall not be realized not be realized as in built function of BB protection. In addition, the LBB protection function shall meet following criteria:
 - a) Be three pole type having three single phase units
 - b) Shall operate for stuck breaker conditions
 - c) Have an operating/resetting time each of less than 15 ms.

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- d) The LBB function shall be initiated by external trip contacts from the Bay Protection Units and after a set time delay shall energize the trip bus in the bus bar protection scheme on which the stuck breaker is connected for tripping of all breakers connected to the particular bus. **For all EHV CBs, a repeat trip command from LBB shall be given to the primary breaker through two separate self reset trip relay on different DC source.**
 - e) Have a setting range of 5 to 80% of rated current
 - f) Have a continuous thermal withstand of 2 times rated current irrespective of the setting.
 - g) Have time delay feature with a continuously adjustable setting range of 0.1 to 1 s.
 - h) Shall be an individual phase comprehensive scheme.
 - i) Shall not operate during the single-phase auto-reclosing period.
 - j) Shall provide end-fault protection that initiates a direct transfer trip to the remote end.
- ii) **Trip Coil Supervision:** A Trip Coil supervision function shall be provided for each lockout trip relay and each of the circuit-breaker trip coils. It shall incorporate both the pre-close and post-close supervision of trip coils and associated trip circuits. An audible alarm shall be given in the event of operation of trip coil supervision function. It shall have a time delay on drop-off of not less than 200ms. Trip coil supervision function as a built-in feature of the BCUs / Bay Protection Units is also acceptable, provided it meets all other requirements specified here, including loss of DC supply.
- iii) **High Speed Trip Relays** supplied under this package shall be:
- a) With operating time of less than 10ms.
 - b) With reset time of less than 20ms.
 - c) Provided with operation indicator for each element/coil.
 - d) Have adequate contacts to meet the scheme requirements of trip, interlock, LBB, auto-reclose, DR, fault locator, etc.
 - e) Hand reset or self reset, depending on the application. Further, the trip relays shall be provided with a feature to receive manual reset command from engineering workstation located in remote.

11.0.0 Bus bar Protection

Each HV bus bar shall be covered with a **duplicated** high-speed busbar protection scheme connected to two different CT cores. Bus bar protection of each HV bus shall operate in a two-out-of-two mode so as to achieve better security.

Each bus bar protection scheme shall:

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- a) Be numerical having modular construction and three pole type.
- b) Main I and Main II shall be connected to different DC source such that even under the failure of either Main I or Main II relays AND/OR failure of the associated DC, the bus bar protection will operate in one out of two mode.
- c) Bay units shall be mounted in respective BPU Panels.
- d) Have a maximum operating time for all types of faults of 20ms at five time the setting value.
- e) Operate selectively for each bus bar.
- f) Give 100% security up to a 50kA fault level.
- g) Incorporate continuous supervision for the CT secondary against any possible open circuit and if it occurs, shall render the relevant zone of protection in-operative. The zone protection contact shall be bypassed automatically and the affected zone shall be protected by the appropriate healthy zone only.
- h) Not give any false operation during normal load flow in bus bars.
- i) Shall not mal-operate for an out-of-zone fault, particularly with current transformer saturation under maximum through fault current with maximum DC offset
- j) Shall provide independent zones of protection and incorporate clear zone indication.
- k) Include individual high speed tripping relays for each feeder, including future ones, as identified in single line diagram.
- l) Be transient free in operation.
- m) Incorporate protection "In-Out" switches for each zone.
 - n) Be a biased differential type, have operate and restraint characteristics and self-monitoring facilities.
 - o) Shall be of phase segregated type with three-pole tripping
 - p) Shall include individual high speed hand reset tripping relays for each bay including Future bays as per Tender SLD
 - q) Shall include continuous DC supply supervision
 - r) Shall include modules for future bays as per Tender SLD.
- s) The Bus bar protection relay shall be connected to the Inter bay communication bus. Use of external CT-switching relays and CT ratio correction relays is not acceptable. The bus bar relay settings and analysis of bus bar fault data shall be possible from the Substation Level.

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12.0 Energy Meters

One no. class 0.2s accuracy energy meters suitable for ABT requirement as specified below shall be provided at each location indicated in respective tender protection SLD.

This metering system shall have following features:

- i. Meters shall be microprocessor-based MWH meters having an accuracy class of 0.2S or better. MVARH meters shall have accuracy class of 0.5 or better.
- ii. These meters shall have provision for downloading of data through an optical port and /or through RS 232/485/ Ethernet port.
- iii. Even under absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meters.
- iv. All these meters shall be networked using Modbus protocol and connected to the Metering Master Station (MMS), provided for the ABT meters.

Dummy panels shall be supplied for mounting of owner's supplied energy meters. These energy meters shall be two (2) nos for each HV line bay and one (1) no. for each generator /generator transformer bay /transformer bay /reactors bay. Terminal blocks (disconnecting type) shall also be provided with these panels. Quantity and dimension of these panels shall be decided during detailed engineering.

Bidder shall supply energy meters along with metering station, 4 nos machine clients, 20 nos web client license, MRI or lap top (as applicable) as per the technical specification given below:

- i. Shall be microprocessor-based conforming to IEC 62052-11, IEC 62053-22, IS 14697
- ii. Shall carry out measurement of active energy (both import and export) and reactive energy (both import and export) by 3-phase, 4 wire principle suitable for balanced/ unbalanced 3 phase load.
- iii. Shall have an accuracy of energy measurement of at least Class 0.2S for active energy and at least Class 0.5 for reactive energy.
- iv. The active and reactive energy shall be directly computed in CT & VT primary ratings.
- v. The reactive energy shall be recorded for each metering interval in four different registers as MVARh (lag) when active export, MVARh (Lag) when active import, MVARh (lead) when active export, MVARh (Lead) when active import.
- vi. Two separate registers shall be provided to record MVARH when system voltage is 103% and when system voltage is 97%.
- vii. Shall compute the net MWh and MVARh during each successive 15-minute block metering interval along with a plus/minus sign, instantaneous MWh, instantaneous MVARh, average frequency of each 15 minutes, net active energy at midnight, , net reactive energy for voltage low and high conditions at each midnight.

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- viii. Each energy meter shall have a display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MWh demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each—phases.
- ix. All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.
- x. At least the following data shall be stored before being over-written for the following parameters:-

	Parameters	Details	Min No. of days
1	Net MWH	15 min block	40 days in meter
2	Aver Freq	15 min block	40 days in meter
3	Net MVARH for V>103%	15 min block	40 days in meter
4	Net MVARH for V<97%	15 min block	40 days in meter
5	Cumulative Net MWH at every midnight	15 min block	10 days in meter/ 40days in PC
6	Cumulative Net MVARH for V>103% at every midnight		10 days in meter/ 40days in PC
7	Cumulative Net MVARH for V<97% at every midnight		10 days in meter/ 40days in PC
8	Date and time blocks of VT failure on any phase		

- xi. Shall have a built in clock and calendar with an accuracy of less than 15 seconds per month drift without assistance of external time synchronizing pulse.
- xii. Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment being supplied by the contractor.
- xiii. The voltage monitoring of shall be inbuilt feature provided to signal failures to the Substation Automation System, The meter shall be suitable to operate with power drawn from the VT supplies.
- xiv. The power supply to the meter shall be healthy even with a single-phase VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built in long life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Even under absence of VT input, energy meter display shall be available and it shall be possible to download data from the energy meter. In case data downloading is not possible in absence of VT supply, meter with provision of 220V DC auxiliary supply shall be provided. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.
- xv. Shall have an optical port on the front of the meter for data collection from either a hand held meter reading instrument (MRI) having a display for energy

TECHNICAL REQUIREMENTS

readings or from a notebook computer with suitable software. The contractor shall supply the MRI and/or notebook complete with all optical interface unit required.

- xvi. A dedicated Metering Master Station (MMS), networked to all the energy meters in contractor's scope shall be provided. The MMS shall be complete to offer the following functionality:
- a) To automatically/manually download the meter data from each meter point at scheduled daily intervals. Manual data download in MMS should not interfere with automatic real time data downloading.
 - b) To create calculated metering points by addition, subtraction, and applying multiplication factors to meter points
 - c) To present the demand of each meter point and calculated meter points in graphical format over specified intervals.
 - d) To calculate the total energy exchanged on meter points or calculated meter points for different time-of-use periods over specified intervals.
 - e) Modify ABT parameters as notified by CERC from time to time.
 - f) To export meter data to Excel format for external analysis.
 - g) Real time display of Generation data- Unitwise, and Station.
 - h) Real time blockwise generation data with SG, DC, Frequency, UI etc. unit wise, and station.
 - i) Commercial report- day wise.
 - j) Monthly commercial performance of station, stage wise and unit wise.
 - k) Auto schedule updation into server after schedule updation in local file/folder of MMS.
 - l) Data polling rate for each meter to be in the range of 3-5 sec.
 - m) Cycle time of server to be less than 1 sec.
 - n) Refresh rate of client screen to be less than 5 sec.
 - o) Alert on non-commercial generation based on frequency, fuel cost etc.

Above features are indicative only. Reports and software features shall be submitted for review and approval during detailed engg stage.

- xvii. The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.
- xviii. Each meter shall have a unique identification code provided by the Owner and shall be permanently marked on the front of the meter and stored in the non volatile memory of the meter.

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13.00.00 Time Synchronization Equipment

- i) Time Synchronization equipment shall be provided so as to synchronize all the devices supplied under this package with the GPS clock. It shall receive Coordinated Universal Time (UTC) transmitted through Geo Positioning Satellite (GPS) for time synchronization of all numerical relays, DRs and the event logger.
- ii) Shall be complete in all respects including antenna, all cables, processing equipment, etc.
- iii) All auxiliary systems and special cables required for synchronization of the equipment shall be supplied and commissioned by the Contractor.
- iv) Shall work from DC supplies only and the Bidder to clarify if any built-in battery back up is provided, in which case, same shall be of long life lithium batteries.
- v) Shall be immune to hostile electrical environment. Suitable protections are to be provided against lightning surges and over-voltages in power supply systems and antenna feeders.
- vi) The system shall be fully tested to the relevant international standards such as IEC: 801 and IEC: 255. One copy of all the test reports shall be enclosed with the bid.
- vii) All numeric protection relays, BCUs, disturbance recorders and the event loggers supplied under this package shall be synchronized with an accuracy of 1ms.
- viii) The system should be able to track more than 1 satellite at a time to ensure no interruptions of synchronization signals.
- ix) The system shall have provisions for combination of any of the following output signals:
 - NTP (network time protocol) 10/100Mbps Ethernet port
 - IRIG-B00x (TTL, pulse width modulated signal)
 - 2 x Pulse per half-hour outputs via potential free contacts rated 48VDC
 - 2 x Pulse per minute outputs via opto-coupler contacts rated 48VDC
 - 1 x Pulse per second outputs via opto-coupler contacts rated 48VDC
 - Alarm status contact indicating healthy status of system
- i) These output ports shall be compatible with the requirement of the equipment to be synchronized. The master clock in control room shall also be synchronized with the time synchronization system.
The actual port requirements (no./type) in line with the system offered shall be finalized during detailed engineering.
- x) The equipment should have a periodic time correction facility of one-sec. periodicity. The equipment shall also have real time display in hour, minute, second (24 hour mode) and have a separate time display unit to be mounted on top of the MIMIC panel, having display size of approx. 144mm height.

14.00.00 RELAY TEST KIT

- i) The required relay test equipment shall comprise the following:
 - One dynamic portable relay test system for allowing dynamic and steady state testing.

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- Any other auxiliary items like phantom loads, etc. required for testing all the protection relays supplied under this contract.
- ii) It shall have the capability to replay the Disturbance / Fault records acquired by the numerical relays / stand-alone DR in IEEE / COMTRADE format or EMTP simulations, to facilitate dynamic testing of all the numerical relays supplied under this contract. The required software for steady state/dynamic testing of all the numerical protection relays, energy meters and transducers, along with a laptop PC, shall also be supplied.
- iii) All commissioning tests on protection relays, energy meters and transducers shall be carried out with this relay test equipment being supplied under this contract and test reports shall be maintained as per the agreed protocols

15.00.00 CONSTRUCTIONAL FEATURES

15.01.00 Panels:

- i. All panels shall be free standing, floor mounting type and completely metal enclosed. Cable entries shall be from the bottom. Panels shall be of IP 31 class or better.
- ii. Panels shall have removable gland plates with glands made of brass and shall be suitable for armoured cables.
- iii. Thickness of panel sides shall be 2mm for Cold Rolled Sheet Steel, 2.5mm for Hot Rolled Sheet Steel.
- iv. Panels shall be painted. The colour of paint for exterior of the panel shall be as follows:
 - I. Ends: Colour-Blue, Shade-RAL5012
 - II. Front and Rear: Colour-Grey, Shade-RAL9002
- v. Panels shall have a lockable front toughened glass door and a swing frame/ fixed rack. Panels shall facilitate direct access to any component mounted inside and shall have at least 20% free space for future expansion.
- vi. Shall be supplied complete with interconnecting wiring between all devices mounted therein.
- vii. All equipment mounted on front and rear side of the panels shall have individual name plates with equipment designation engraved. Each panel shall also have circuit/feeder designation name plate.
- viii. Each panel shall be provided with a 240V AC fluorescent lighting fixture controlled by door switch as well as a 5A, 240V AC switch-socket unit.
- ix. Shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of AC & DC supplies for various circuits for control, signaling, lighting, interlocking, etc. Selection of main and sub-circuit fuse rating shall ensure selective clearance of the sub-circuit faults.

TECHNICAL REQUIREMENTS

- x. Voltage circuits for protection and metering shall be protected by fuses. Suitable fuse failure relays shall be provided to give an alarm for voltage circuits of protection/metering. Voltage selection scheme based on relays shall be provided for meters wherever applicable.
- xi. The DC supplies at the individual relay and protection panels shall be monitored and failure of DC supplies shall be annunciated.

15.02.00 Earthing

- i. The panels shall be equipped with an earth bus of at least 50x6mm² galvanized steel flat bar or equivalent copper.
- ii. Earth buses of adjoining panels shall be connected for continuity. The continuous earth bus so formed shall be connected to the main earth grid at one end only.
- iii. All metallic cases of the mounted equipment shall be separately connected to the earth bus by 2.5mm² copper wires. No loops in the earth wiring shall be permitted.
- iv. CT/VT neutral secondary shall only be earthed at the terminal block of the panel through links, such that the earthing of one group may be removed without disturbing others.
- v. An independent Electronic Earth System shall be provided as per contractor's standard. The electronic earth shall be connected to the substation earth mat through a dedicated riser.

15.03.00 Wiring

Internal wiring to be connected to external equipment shall terminate on terminal blocks.

The terminal blocks for CTs and VTs shall be provided with test links and isolating facilities. The CT terminal blocks shall be provided with short circuiting and earthing facilities.

Shall have 20% terminals as spare terminals in each panel.

All equipment mounted on front and rear side of the panels shall have individual name-plates with equipment designation engraved. Each panel shall also have circuit/feeder designation name plate.

All wiring shall be with 1.1 KV grade, single core, PVC insulated stranded copper conductor.

Wires shall be vermin proof. Minimum size of conductor shall be 1.5 mm² in general, but for CT & VT circuits it shall be 2.5 mm². Minimum number of strands shall be three.

Contractor shall be solely responsible for completeness and correctness of all the wiring, and for proper functioning of the connected equipment.

16.00.00 TRANSDUCERS

- a) Shall conform to IEC: 688-1.
- b) The output of the transducers shall be 4-20mA/0-10mA/10-0-10mA dc as necessary for the instruments.
- c) Accuracy class shall be 0.5 or better except for frequency transducer, which shall have an accuracy of 0.2.

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- d) Summation transducer shall be suitable for taking multiple inputs from individual MW/MVAR transducers.
- e) Shall have dual output. One output shall be used for the indicating instrument/recorder provided and other shall be wired up to terminal block of the panel for Owner's use in future.
- f) Energy transducers shall be suitable for 3 phase, 4 wire connection.
- g) Tap position transducer shall measure Resistance Input from Potentiometric Transformer

17.00.00

CONTROL CABLING PHILOSOPHY

- i. a Each secondary core of all the phase CT/CVT shall be brought to the equipment marshalling box through independent cables.
- ii. Each three phase secondary core of each CT/CVT shall be brought to the associated control/relay panel from the equipment marshalling box through independent cables.
- iii. Duplicated cores with at least 2 x 2.5 sq.mm² CU/equivalent core cross-sectional area per connection shall be used for connection of all CT/CVT circuits.
- iv. VT leads used for tariff metering shall have an equivalent core cross-sectional area of at least 10 mm² CU/equivalent per phase/neutral connection.
- v. Duplicate channels of protection shall have independent cables for tripping, DC supply, etc. Duplicated cores shall be used for ALL closing/tripping commands and interlocking signals involving long (MORE THAN 500 m) cable lengths, such as interfacing between SWYD and SWGR/ GRP.
- vi. For the following applications multiple cores with at least 2 x 2.5 mm² CU / equivalent core cross - sectional area per connection shall be used:
 - a) DC supply to Bay Marshalling box
 - b) DC supply to circuit-breaker cubicle
 - c) DC looping for closing and tripping circuits of circuit-breaker
- vii. All the interconnections (both AC/DC) within the switchyard and between switchyard and other systems required for the successful implementation of the control, interlocks and protection schemes under present package, as shown in the tender drawings for protection, control philosophy and substation automation architecture, shall be in the scope of the bidder. Such interconnections between switchyard and other system shall include but not limited to the following:
 - a) CT connections 11kV switchgear / transformer MB to SWYD AC Kiosk /Control Room/**GRP** for transformer protections as per relevant protection SLD. General Layout Plan of the plant showing the location of all such systems are included as a tender drawing.
 - b) CT connections from SWYD to GRP and **Generator Bus duct to GRP** in line with GRP protection S LD.
 - c) Extension of switchyard bus voltages to respective GRPs for transducer circuit and Generator synchronizing circuit.
 - d) Extension of manual closing and tripping commands from the coupling relays in GRP to EHV generator breakers through BCU / control panel.
 - e) Necessary cabling from SWYD CR to GRP for protection interfacing, Generator EHV breaker closing interlock and signal exchange between switchyard and GRP.

TECHNICAL REQUIREMENTS

- f) Any special cables (other than 1.5 sq.mm unarmoured required for the implementation of the protections being provided by the bidder.(eg: 100% stator E/F, Rotor E/F etc)
 - g) Necessary interconnections for the Inter tripping / closing interlocking between upstream and downstream systems for station transformer / miscellaneous transformer / unit transformer/ excitation system.
 - h) Necessary interconnections from transformer MB to RTCC / BCU (located in SWYD Bay Kiosks) for OLTC control & monitoring.
 - i) Any screened cable required for connecting 4-20 mA analog signals.
 - j) Necessary cabling between Transformer MB and SWYD Bay Kiosks / Control Room/ GRP for various Transformer / Reactor monitoring system and fire protection system.
 - k) Cables from Bay-kiosk to SAS for monitoring /control of Air-conditions and Fire-detection system
 - l) Necessary interconnections for signal exchange between SWYD / SWYD CR to interfacing panels of RLDC, DCS wherever applicable.
- viii. Spare cores shall be provided as per following norms:
- a) Up to 3-core cable - Nil
 - b) 5 Core Cable - Min. 1 core
 - c) 6 to 14 core cables - Min. 2 cores
 - d) More than 14 core - Min. 3 cores

18.00.00 Type Test Requirements

Test reports for following type tests shall be submitted for all BCUs / BPU's / DR / Energy Meter. Reports / Certificates of tests conducted in accredited Laboratories (accredited by the national accrediting body of the country where the lab is located) are also acceptable.

Numerical Relays(BCU/BPU)

A. Insulation Tests:

Sl. No.	Description	Standard
1.	Dielectric Withstand Tests	IEC 60255-27 <ul style="list-style-type: none"> • 2kV rms for 1 min between each circuit and the accessible conductive parts, the terminals of each independent circuit being connected together; • 2kV rms for 1 min between independent circuits, the terminals of each independent circuit being connected together.

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		ANSI/IEEE C37.90 <ul style="list-style-type: none">• 1kV rms for 1 minute across the open contacts of the watchdog relays.• 1kV rms for 1 minute across open contacts of changeover output relays.• 1.5kV rms for 1 minute across open contacts of normally open output relays.
2.	High Voltage Impulse Category III to verify est, <ul style="list-style-type: none">• Clearances• Solid insulation	C 60255-27

TECHNICAL REQUIREMENTS

B. Electrical Environment Tests: (For Zone A installations)

1.	AC & DC Voltage dips	IEC 60255-26
2.	AC & DC voltage Interruptions	IEC 60255-26
3.	AC component in DC (Ripple)	IEC 60255-26
4.	Gradual Shutdown/ Startup (for DC power supply)	IEC 60255-26
	Immunity	
1.	Slow Damped Oscillatory Wave	IEC 60255-26
2.	Fast Transients	IEC 60255-26 Class 4 installation as per base standard IEC61000-4-4.
3.	Electrostatic Discharge	IEC 60255-26 Class 4 installation as per base standard IEC61000-4-2.
4.	Surge Immunity	IEC 60255-26 Class 4 installation as per base standard IEC61000-4-5.
5.	Power Frequency Magnetic Field	IEC 60255-26, Class 5 installation as per base standard IEC61000-4-8.
6.	Radiated Radio Frequency Electromagnetic Field	IEC 60255-26 Class 4 installation as per base standard IEC61000-4-3.
7.	Conducted disturbance induced by radio frequency fields.	IEC 60255-26 Class 4 installation as per base standard IEC61000-4-6

TECHNICAL REQUIREMENTS

8.	Power Frequency immunity test on DC binary Input	IEC 60255-26 Class 4 installation as per base standard IEC61000-4-16.
9.	Interference Voltage, Aux. Voltage (Conducted Emission)	IEC 60255-26
10.	Interference Field Strength (Radiated Emission)	IEC 60255-26

C. Atmospheric Environment Tests:

Sl. No.	Description	Standard
1.	Climatic Environmental Requirements: Cold Dry Heat Change of temperature Damp Heat	IEC 60068-2-14, IEC 60068-2-1 IEC 60068-2, IEC 60068-2-78 &IEC60068-2-30, IEC60255-27

D. Mechanical Stress Tests:

Sl. No.	Description	Standard
1.	Vibration (during Operation and Transportation)	C 60255-21-1
2.	C 60255-21-2	IEC 60255-21-2
3	Seismic Vibration (during Operation)	C 60255-21-3

18.02.00

ENERGY METER

All type test reports as per IEC 62052-11/IEC 62053-22

18.03.00

DISTURBANCE RECORDER AND EVENT LOGGER

Type test reports for the following tests shall be submitted

- a) High Voltage Impulse Test, class III as per IEC 60255-27
- b) High Frequency Disturbance as per IEC 60255-26, class IV
- c) Fast Transient Disturbance as per IEC 60255-26, class IV

PART-B

VOLUME – II

CHAPTER – II-E15

33KV GIS

TECHNICAL REQUIREMENTS

1.00.00 GENERAL

1.01.00 The Technical specifications cover the detailed requirements for design, manufacturing, supply, installation, testing and commissioning of Metal Enclosed SF6 Gas Insulated 33KV Gas Insulated Switchgear. The switchgear shall be an indoor gas-insulated metal clad cubicle design conforming to IEC 62271-200 with double bus bar system configuration (as shown in Tender SLD) having following:

- Separate Busbars, Disconnectors and CB compartment
- Separate cable termination compartment
- All live parts hermetically sealed

Combined bus-bar and disconnector/earth switches compartment is also acceptable.

Requirement for protection, control & monitoring and metering are specified in other relevant chapters in the Technical specification. The control & monitoring, protection and metering panels shall be installed in the GIS relay room.

2.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

2.01.00 The GIS shall be of compact and of modular design. The modular design should allow the maintenance/replacement of the circuit breaker or cable connection compartment without interrupting the main horizontal bus bar operation. Switchgear shall be arranged to permit future extension at both the ends without necessarily dismantling any major parts of the equipment.

2.02.00 It shall be possible to extend the switchgear by adding further feeders with at least one of the bus bar system and the existing feeders remaining in service continuously.

2.03.00 All high voltage components shall be hermetically enclosed and safe to touch. The switchgear shall be a sealed pressure system as per IEC with leakage rate of less than 0.1% per year.

2.04.00 The bus bar as well as feeder shall be single phase or three phase encapsulated type. The enclosure shall be made of aluminium alloy/stainless steel with

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adequate thickness and mechanical strength to have minimum corrosion and lesser weights.

- 2.05.00 The switchgear shall be designed for use with SF6 gas complying with the recommendation of IEC 60376 at the time of the first charging with gas. All SF6 gas supplied as part of the contract shall comply with requirements of IEC 60376 as a minimum.
- 2.06.00 The degree of protection shall be at least IP65 for gas compartments and IP3X for the supporting frame and other compartments.
- 2.07.00 Each bay shall be divided into functionally separate gas compartments (busbar, disconnectors/earth switches, circuit breaker etc) by gas tight partitions. All the gas compartments shall be assessed via maintenance connections. The gas compartments shall be distributed in such a way that if work is done on one bus bar system, then the second bus bar shall remain in operation with all feeders without interruption and maintaining full insulation level.
- 2.08.00 Automatic pressure relief shall be incorporated in the basic design of the enclosures as a precaution against explosion in the event of an internal arc fault. It shall ensure that personnel who may be present will not be endangered. Pressure relief shall be provided for all gas filled compartments.
- 2.09.00 The number and position of expansion joint or flexible connections if applicable, are to be determined by the manufacturer to ensure that the complete installation will not be subject to any expansions stresses which could lead to distortion or premature failure of any piece of the SF6 equipment, support structures or foundations.
- 2.10.00 Gas section barrier including seals to the conductor and enclosure wall shall be gastight and shall be capable of withstanding the maximum pressure differential that could occur across the barrier that can exist under normal operating or maintenance conditions and in case of internal arc fault with a safety factor ≥ 2.0 .
- 2.11.00 Switchgear panels, Bus bars, Disconnectors/Earth switch , Circuit Breaker and other equipment shall have following features:

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2.11.01 **Conductor:** High conductivity aluminium/copper for the horizontal bus bars, vertical droppers and connectors to the fixed end of isolating contacts.

2.11.02 **Insulator:** Insulator Shall be track-resistant, high strength, non-hygroscopic, non-combustible type and suitable to withstand stresses due to over-voltages and short circuit current.

2.11.03 **Bus bars**

Bus bars and connections shall be manufactured from high conductivity aluminium or copper and same shall be housed in Sf6 gas compartment. The Bus bar Coupling arrangement for connecting two panels shall be housed in SF6 gas or other suitable arrangement as per the manufacturer's practice. If it is not coupled inside SF6 Gas, the details shall be furnished by the Contractor for approval by Employer. Proven track record of the arrangement shall be provided. To absorb thermal expansion and contraction movements, suitable compensation joints must be fitted if necessary. It must be possible to earth all bus bar sections in a make-proof way.

Contractor shall furnish calculation during detailed engineering stage to establish the adequacy of support insulator and bus bar sizes for the declared continuous & short time current ratings.

2.11.04 **Circuit Breakers**

The circuit breaker module shall have two main components, interrupter unit and operating mechanism. Interrupter unit shall be housed in Sf6 gas compartment. The circuit breaker shall be suitable to combat the arc quenching efficiently during breaking with high value of short circuit current without any harm to operating personnel and breaker itself.

The circuit breaker shall meet the following requirements:

a) The breaker shall be controlled locally and/ or remotely as required. Facilities shall be provided for mechanical tripping of breaker and manual charging of closing spring to cater to emergency condition.

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- b) Closing coils shall operate satisfactorily in the control voltage range of 85 - 110% and tripping coil shall operate satisfactorily in the control voltage range of 70% - 110%.
- d) Suitable mechanical inter lock shall be provided to prevent inadvertent earthing of any live part.
- e) Each feeder shall have local – Remote selection. The arrangement of the circuit-breaker in the panel should be such that in the event of any requirement both the operating mechanism and the arcing chambers can be removed and reinstalled from the front or back. The Closing & tripping of the breakers from remote/local shall be possible.
- f) In the event of failure of auxiliary motor supply the disconnecter and circuit breaker should be able to operate manually from panel front.

The operating mechanism shall be spring operated type installed in compact separate free standing aluminum/steel housing. The entire operating mechanism shall be completely isolated from SF6 gas compartment. The operating mechanism shall have vibration free and almost maintenance free components. The switching operation shall continue operating even after control power supply fails.

2.11.05 **Disconnector/Earth Switch**

Disconnector shall be of the single pole group operated type housed in the gas compartment conforming to IEC-62271-102. 3 – position combined disconnector and earth switch shall be provided for bus section – I and 2 position disconnector switch for bus section II for operation of feeder. Design of disconnector switch for bus section II shall be suitable for 3 position disconnector switch. The three position switch shall be capable of make proof feeder earthing in combination with circuit breaker.

Disconnectors shall be able to switch capacitive charging current and bus transfer current. Linear motion disconnectors shall be arranged co-axially with active parts. They shall be mechanically coupled with the position indicator.

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Viewing glass shall also be provided to check contact position. Manual operation shall also be possible.

2.11.06 Instrument Transformer

Current and potential transformers shall conform to IEC 61869. Current and potential transformers shall be cast-resin insulated. The primary and secondary terminals shall be marked indelibly and easily approachable for termination and testing etc. All transformers must be suitable for continuous operation for 20% overload and for service under all rated and fault conditions.

i) Current Transformers

Current transformer shall be of Toroidal/ring core type construction. The CT ratio, ratings, class of accuracy, VA burden, number of cores, etc shall be finalized during detailed engineering stage based on the system requirement.

Current transformer shall be mounted on the circuit breaker compartment, flanges or, on the cable connection housing. Variable number of cores and secondary winding shall be provided depending upon requirement.

ii) Potential Transformers

PT shall be inductive type, cast resin insulated voltage transformers in metal enclosed safe to touch design. PT shall be located outside the gas compartments. Bus PT shall be connected to bus through 3 position disconnect switch. Line PT can be plugged directly on the cable connection or connected through separate cable. PT shall have one or more secondary windings as per requirement. Modules or touch proof metal clad plug in type directly on bus bar/cable connection housing with secondary terminals kept accessible outside for metering as well as for protection and synchronization. The PT ratio, ratings, class of accuracy, VA burden, etc shall be finalized during detailed engineering stage.

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2.11.07 **Surge Arrestor**

The surge arrestors shall conform in general to latest IEC –60099-4. The surge arrester shall have minimum following duty requirements:

- i) The surge arrester shall be of heavy duty station class and gapless (Metal oxide) type without any series or shunt gaps.
- ii) The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers, reactors and long lines.
- iii) The reference current of the arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

Constructional Features:

- i) The nonlinear blocks shall be of inferred metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.
- ii) The arrester enclosure shall be vertically or horizontally mounted to suit the layout of the switchgear as suggested by the manufacturer and shall be fitted with a discharge counter located in an easily accessible position.
- iii) The main earthing connection from the surge arrester to the earth shall be provided. The size of the connecting conductor shall be such that all the energy is dissipated to the earth without getting overheated.

2.11.08 **Power Termination Modules**

Termination modules shall be for cables only. Cable connections shall be accessible from the beneath through the cable duct or the cable vault. Cable connections shall be either inner cone/outer cone type.

2.11.09 **Local Control Cabinets**

Intelligent local digital modules shall be provided with extensive diagnostic and monitoring features. They shall have local control, indication and monitoring of breaker with associated disconnectors and earth switches. The interlock shall be

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provided to prevent any incorrect switching sequence and enable the breaker, disconnectors, earth switches to be operated without risk either from local control cabinet or from remote control room.

2.11.10 **Sealing Arrangements:** All power parts like bus bar compartment, breaker compartment etc must be electrically connected through bushing type insulators or other sealing arrangement in order to perform sealing and segregation and should not have SF6 gas communication.

2.11.11 **Earthing Arrangement**

All metallic non-current carrying parts of the switchgear shall be bonded together and connected to the switchgear earth busbar. Internal earth bus shall be provided which has a capacity to withstand short circuit currents for one second and all enclosures shall be connected to this bus.

2.11.12 **Cable Entry**

i) Touch proof cable termination shall be provided. Necessary cable termination kit shall also be provided by the Contractor. All high voltage XLPE cables shall be terminated by Contractor. All necessary cable connectors shall be supplied as per system requirement.

ii) Capacitive Voltage Dividers in the bushings leading to the cable termination should allow safe testing and indication of the cable and the dead state at the Switchgear end. These dividers must be a fixed integral part of the system. The indicators shall preferably be mounted on the front side of the panels. These live line indicators shall be used for checking charged condition of the power cables while performing maintenance.

2.11.13 **SF6 monitoring**

SF6 gas pressure / density monitoring for low pressure alarm shall be provided. The SF6 gas pressure measurement gauges shall be suitably placed so as to be visible from walkway. The switchgear manufacturer shall indicate the basic insulation level at 1 bar gas pressure. The current rating of the feeders shall be maintained at this pressure without interrupting the supply of power. All SF6

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stainless steel/Al tank enclosures shall have independent temperature compensated pressure switches/pressure monitoring devices. The gas compartments must be well sealed both mutually and to their surroundings.

2.11.14 Identification Plates

Each panel to be identified on front as well as back side by large engraved plate giving detailed feeder description on the fixed portion of the panel. Identification labels/painted (Not stickers) plates to be provided inside each panel.

2.11.15 Safety Requirements

The switchgears shall be designed to offer adequate level of safety to operating/maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Contractor shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switch gear room describing various safe operating procedure / safety precautions for safe operation and maintenance of switchgear.

2.12.00 **Gas Recycling Plant:** All equipment necessary for filling, evacuating and recycling the SF6 gas into and from the switchgear equipment including maintenance activity in circuit breaker compartments shall be supplied by the vendor to enable any maintenance work to be carried out. The equipment shall be of sufficient capacity and rating and shall be provided with all necessary pipes, couplings, flexible tubes and valves for coupling to the switchgear equipment.

3.00.00 DATA REQUIREMENT

3.01.00 The rating and electrical characteristics of 33KV GIS panels and associated equipment shall be as under:

Technical Details

1. System particulars

a) Normal system voltage: 33kV

TECHNICAL REQUIREMENTS

b) High voltage system voltage:	36kV
c) Frequency :	50 Hz (+3% -5%/)
d) Number of phases:	3
e) Class indoor/outdoor:	Indoor
f) Rated short circuit withstand of the panels	40KA
g) Rated insulation level	
i) Rated power frequency withstand voltage (rms value):	70 kV
ii) Rated lightning impulse withstand voltage (peak value):	170 kVp
h) Rated supply voltage	220 V DC (Control Supply)
Closing and opening devices and auxiliary circuits	240 V AC (Aux. Supply)
i) Internal arc fault	IAC AFLR 40KA for 1Sec.
j) Ambient Temp.	50 Deg C
k) Minimum Creepage distance:	Suitable to withstand BIL at rated SF6 gas pressure
2. Type of Construction:	Metal clad, fully compartmentalized, SF6 Insulated, for indoor application

3. Circuit breaker Parameters

a) Type of Breaker:	Vacuum /SF6 Interrupter, S ₆ gas Insulated
b) Number of poles:	3

TECHNICAL REQUIREMENTS

c) Highest system voltage:	36kV
d) Rated normal current:	As per system requirements
e) Rated frequency:	50 Hz + 3% -5%
f) Breaking current:	40KA
g) Rated short time withstand current:	40KA
h) Rated Operating Duty	O-0.3 S – CO – 3 Min – CO
i) Mechanical Endurance	M2 class
j) Rated duration of Short circuit	3 second
k) Class indoor/outdoor	Indoor
l) No. of Auxiliary	6NO + 6NC Contacts for Contacts for Employer's use (If required NO and NC are not available, auxiliary relays to be used for multiply the contacts)

4. Disconnect/Earth Switch:

a) Type:	Sf6 gas Insulated (3Position/2position as per requirement)
b) Number of poles:	3
c) Highest system voltage:	36kV
d) Rated normal current:	As per system requirements
e) Rated frequency:	50 Hz + 3% -5%

TECHNICAL REQUIREMENTS

- i) Mechanical Endurance M2 class
- l) No. of Auxiliary 6NO + 6NC Contacts for
Contacts for Employer's use
(If required NO and NC are not available, auxiliary relays to be used for multiply the contacts)

5. Current transformers

- a) Class of insulation Class E or better

CT sizing calculation shall be done during detailed engineering based on system requirement.

6. Potential Transformers

- a) Class of insulation Class E or better
- b) Rated voltage factor 1.2 continuous & 1.9
for 30 sec

PT sizing calculation shall be done during detailed engineering based on system requirement.

4.00.00 SPECIAL REQUIREMENTS

4.01.00 Earthquake Condition

Under the seismic conditions, stipulated in this specification (mentioned elsewhere), the 33kV GIS panels shall meet the following requirements:

- a. The physical alignment of 33kV GIS panels along with incoming and outgoing feeder connections, supporting insulators & structures of bus bars should not get disturbed and there should not be any internal flashover and/or electrical fault.

TECHNICAL REQUIREMENTS

b. All relays, transducers, indicating instruments, devices in switchgears or in Remote control panels should not mal operate.

c. Current carrying parts, supporting structure, earth connection etc. should not get dislocated and /or should not break or distort.

5.00.00 Dispatch and Handling of equipment at site

Care shall be taken for safe handling of equipment at site during transport, stacking, shifting to erection site, and erection at site in order to prevent damages to the equipment. The compartments of GIS assemblies should be supplied filled with SF6 gas at a positive pressure and hermetically sealed to protect the dielectric system during transportation as per manufacturer practice.

6.00.00 Tests

6.01.00 Type Tests

The metal enclosed 33KV Gas Insulated Switchgear shall be of type tested design. During detailed engineering Contractor shall submit for Owner's approval the reports for all the type test as per relevant IEC/IS and carried out within last ten years from the date of bid opening.

6.02.00 Site Tests

After complete erection at the site all the test as recommended by manufacturer and relevant standards shall be performed.

7.00.00 33KV DISCONNECTORS (AIS)

GENERAL

- a) The isolators and accessories shall conform in general to IEC (or equivalent Indian standard) except to the extent explicitly modified in specification.
- b) Earth switches shall be provided on isolators wherever called for.
- c) The isolators and earth switches shall be motor operated.
- d) Complete isolator with all the necessary items for successful operation shall be supplied.
- e) Isolators shall be three pole operated.

TECHNICAL REQUIREMENTS

CONSTRUCTIONAL FEATURES

- a) The isolators shall be provided with high pressure current carrying contacts on the hinge/ jaw ends and all contact surfaces shall be silver plated. The thickness of silver plating should not be less than 25 microns. The contacts shall be accurately machined and self-aligned.
- b) The isolator shall be provided with a galvanised steel base provided with holes and designed for mounting on a lattice/pipe support structure. The base shall be rigid and self-supporting. The position of movable contact system (main blades) of each of the isolator and earthing switch shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the isolator and earthing switch. The indicator shall be of metal and shall be visible from operating level.
- c) All metal parts shall be of non-rusting and non-corroding metal. Current carrying parts shall be from high conductivity electrolytic copper/aluminium. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities, if provided on current carrying parts, shall be made of copper silicon alloy or equivalent. The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces.
- d) The isolators shall be so constructed that the switch blade will not fall to the closed position if the operating shaft gets disconnected. Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by gravity, wind pressure, vibrations shocks or accidental touching of the connecting rods of the operating mechanism. The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals.
- e) The insulator of the isolator shall conform to the requirements stipulated under relevant standards.
- f) The terminal connectors shall conform to requirements stipulated under relevant standards.

EARTHING SWITCHES

Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts. The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator. Earthing switches shall be suitable for local operation only. The earthing switches shall be constructional interlocked with the isolator so

TECHNICAL REQUIREMENTS

that the earthing switches can be operated only when isolator is open and vice versa.

OPERATING MECHANISM AND CONTROL

- a) The Contractor shall offer, motor operated switches having padlock arrangement on both 'ON' and 'OFF' positions.
- b) Limit switches for control shall be fitted on the isolator/ earth switch shaft, within the cabinet to sense the open and close positions of the isolators and earth switches.
- c) It shall not be possible, after final adjustment has been made for any part of the mechanism to be displaced at any point in the travel sufficient enough to allow improper functioning of the isolator when the isolator is opened or closed at any speed.

OPERATION

- a) Isolator shall be gang operated for main blades and earth switches. The operation of the three poles shall be well synchronised and interlocked.
- b) The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and interpole operating rods shall be capable of adjustments.
- c) The design of linkages and gears be such so as to allow one man to operate the handle with ease for isolator and earth switch.

TESTS

Isolator along with operating mechanism shall conform to the type tests and shall be subjected to routine tests and acceptance tests in accordance with IEC 62271-102.

PARAMETERS

General

- | | |
|-----------------------------------|--|
| a) Type of isolator | Outdoor type |
| b) Rated frequency | 50 Hz |
| c) Number of poles | Three (3) |
| d) Operating time | Not more than 12 sec. |
| e) Control voltage | 220V DC |
| f) Auxiliary contacts on Isolator | As required plus 4NO and 4NC. The contacts shall have continuous rating of 10A and breaking capacity of 2A |

TECHNICAL REQUIREMENTS

with circuit time constant of minimum 20 millisecond at 220V dc. Additionally MBB contacts as required shall also be provided.

- g) Auxiliary contacts on earth switch 4NO and 4NC
- h) Rated mechanical terminal load As per IEC 62271-102
- i) Temperature rise over ambient As per IEC:62271-102
- j) Minimum creepage distance 900mm
- k) Rated ambient temperature 50 degree Celcius

- l) System neutral earthing Effectively earthed

- m) Seismic acceleration 0.3 g horizontal
- n) Support structure height Adequate so that lowest part of support insulator of equipment is minimum 2550 mm from ground or plinth level.
- o) Rated mechanical terminal Load As per IEC 62271-102
- p) Operating mechanism of Isolator and Earth Switch A.C./ D.C./ Universal Motor operated

33KV Isolators:

- a) Voltage Class 36 kV rms
- b) Rated continuous current As per SLD
- c) Rated short time withstand current second of isolator and earth switch 40kArms for Three(3)
- d) Rated dynamic short circuit withstand current of isolator and earth switch 62.5 kAp
- e) Rated Insulation levels
- i. Rated one minute power 70 KV (rms)

TECHNICAL REQUIREMENTS

Frequency withstand voltage	
ii. Rated lightning impulse	170 kV (Peak)
Withstand voltage	

PART-B
VOLUME – III
CHAPTER – III-C
CONTROL & INSTRUMENTATION

TECHNICAL REQUIREMENTS

1.00.00 BASIC DESIGN CRITERIA

- 1.01.00 The Contractor shall provide Independent Control & Instrumentation system for control, monitoring and operation of associated drives in all regimes of operation in safe and most efficient manner including Primary and Secondary Instruments, Panels/ Desks, Process Connection and Piping, charges & batteries, associated Instrumentation Cables, Control Valves etc. as identified in the specification.
- 1.02.00 Each component and system offered by the Contractor shall be of established reliability. The minimum target reliability of each piece of equipment like each electronic module/card, Power supply, Peripheral etc. shall be established by the Contractor, considering its failure rate/mean time between failures (MTBF), meantime to repair (MTTR), such that the availability of the complete C&I system is assured.
- 1.03.00 The system shall be arranged so that the failure of any monitoring device or control components or spurious intermediate grounding in the signal path shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same signal.
- 1.04.00 To ensure availability, adequate redundancy in system design shall be provided at hardware, software and sensor level. For the protection system, independent sensing device shall be provided to ensure adequate safety of plant equipment.
- 1.05.00 The design of the control systems and related equipments shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved and shall not cause a hazardous condition. However, it shall also be ensured that occurrence of false trips are avoided / minimized.
- 1.06.00 The types of failure that shall be taken into account for ensuring operability of the plant shall include but shall not be limited to – Failure of sensor/transmitter, main and/or redundant controller/other modules, motive power to final control element, control power, instrument air etc.
- 1.07.00 The equipment shall employ latest state of the art technology to guard against obsolescence. In any case, Contractor shall be required to ensure supply of spare parts for lifetime of the plant. In case, the Contractor feels that certain equipment/component is likely to become obsolete, the Contractor shall clearly bring out the same in his Bid and indicate steps proposed to deal with such obsolescence.
- 1.08.00 Instruments, devices and equipment's for outdoor and indoor locations without air conditioning shall be designed to withstand max. 55 Deg C & 100% Relative Humidity and its protection class should be minimum IP 55. For air conditioned areas or panels (With a suitable canopy at the top to prevent ingress of dripping water), they should be designed to withstand max. 50 Deg C (during AC Failure) & 95% Relative Humidity and its protection class should be minimum IP 22.
- For PCs, OWS, EWS, Servers, Printers and other peripherals, maximum temperature limit shall be 35 Deg.C. For mini-UPS, the same shall be 40 Deg.C.
- 1.09.00 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels.
- The system ground shall be isolated from the panel ground with suitable isolators. All internal component grounds or common shall be connected to the system ground, which shall be fabricated of copper flat (size 25mm x 6mm min., length as applicable).
- Shield on instrumentation cables shall be grounded on panel side.
- Grounding scheme shall be as finalized during detailed engineering.

TECHNICAL REQUIREMENTS

2.00.00 **PROGRAMMABLE LOGIC CONTROLLER**

2.01.00 **STANDARDS FOR COMPLIANCE**

- 2.01.01 The PLC shall comply with the latest versions of the following Standards and Specifications as a minimum.
- 2.01.02 Requirement specific to programmable controllers: Functional characteristics, Immunity, Resistance, Safety etc.: IEC / EN 61131-2 and IEC / EN 61010-2-201; IEC-61131-3 [Programming Language Standard]
- 2.01.03 ISA S 71.01 [Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity].
- 2.01.04 IEC-62443 [Standard for Cyber security].

2.02.00 **PLC SYSTEM REQUIREMENTS**

- 2.02.01 The PLC (Programmable Logic Controller) shall be chosen for simplicity, use of established proven components, use of techniques that minimize the need for maintenance, ease of configuration and overall integrity of design.
- 2.02.02 It shall be possible to remove / replace online, various modules (like Controller, I/O module, interface module, etc.) from its slot for maintenance purpose without switching off power supply to the corresponding rack. System design shall ensure that while doing so, undefined signaling and releases do not occur and controller operation in any way is not affected (including controller trip to manual, etc) except that information related to removed module is not available to controller.
- 2.02.03 All Electronic modules of PLC shall have conformal protective coating as per G3 / GX classification in accordance with ISA S-71.04 standard. The conformal coating version shall be a standard product from the manufacturer's factory. The hardware that is being conformal coated locally shall not be acceptable.
- 2.02.04 The system design shall be modular and scalable to facilitate easy system expansion. Further it shall ensure that no single failure in the system results in loss of system operation.
- 2.02.05 Details of various components and associated systems shall be as given below :
 - a) Processor Two (2) numbers, one as primary and another as hot standby. It shall be based on dual core multi-function microprocessor technology as a minimum and shall carry the latest error correction (ECC) technology.
 - b) Controller Redundancy Controllers shall be fully redundant operating in Hot-standby mode. The hot standby configuration hardware shall be based on two separate identical hardware configuration set. Either controller can serve as primary or backup. The Hot-standby function shall be the inherent property of the controllers. Engineered solutions developed for implementing redundancy functionality, for example switch over function shall not be acceptable. Wherever multiple functional groups have been specified / are required, the above requirements are applicable for each functional group.
 - c) Memory Integrated flash memory based on Maintenance free battery-less design on its mother board. Internal Memory shall be non-volatile, based on latest semiconductor (NAND flash) storage technology and scalable (min. 8 MB) for programming, process application and data storage. In case of non-scalable memory based design, minimum 16 MB shall be provided. CPU memory shall have minimum 30% spare capacity for future use.
 - d) I/O racks and modules Modular design. All input/output cards shall have quick disconnect terminations allowing for card replacement without disconnection of external wiring and without switching of power supply. In general, all Output cards shall be sourcing type and Input cards shall be sinking type.
 - e) Analog Signal conditioning Galvanic isolation of input and output signals for which power supply source is derived from source external to the control system power supply.

Transmitter power supply with per point current limiting or fuse protection for loop powered transmitters.

Monitor sensor wire break/open circuit/short circuit and take suitable

TECHNICAL REQUIREMENTS

- actions in logic/loop. (This will include blocking of trip signals in case of RTD failure).
- All analog outputs shall be short circuit proof.
- f) Isolation between Input, Output and controller 1.5 KV with opto couplers.
- g) Diagnostics & Indication Channel Level Diagnostics (with reverse polarity, wire break, short circuit & optical /galvanic isolation) for DI / DO, AI & AO shall be provided. Each individual Channel healthiness shall be monitored at workstation / GUI level.
Individual signal status of each Input / Output, power supply status shall be indicated on the module faceplates.
- h) Fail safe mode The PLC system shall be "Fault tolerant". On power supply failure / both PLCs failure / communication failure etc. the output shall be automatically switched over to fail safe mode. In CPU, memory should record when / where the sequence was aborted. Further, in case of such failures, operating drives / equipment shall be tripped or kept running as per a pre-determined programmable requirement finalized during detailed engineering.
- i) Fusing philosophy Individual fuses with blown fuse indicator for each output. Individual fuses for each input/ group of inputs, keeping in view of system availability.
- j) Switching capacity Output modules shall be rated to switch on/off coupling relays of 3VA at 24V DC and solenoid valves at 110 V AC.
- k) Data Communication Sub-System The communication sub-system shall be a digital communication bus, based on standard Ethernet technology as its infrastructure backbone Based on existing IEEE 802.3 Ethernet standards, the network system shall be compatible with commercial off-the-shelf Ethernet products. HMI network between controllers and HMI devices shall be a minimum 100 Mbps redundant Ethernet control network (based on TCP/IP) to ensure high availability. Similarly the redundant I/O bus / ring network shall be based on TCP / IP with minimum 100 Mbps data transmission speed.
- l) Provision for Third Party Connectivity The PLC system shall be OPC compliant and shall be provided with necessary hardware and software for successfully establishing dual redundant fiber optic/ wireless connectivity using bidirectional OPC communication through OPC DA / UA protocol.
Suitable OPC server and client software and sufficient no. of licenses shall be procured by the contractor for fully meeting the intent as stated above.
- m) Support for standard industrial communication protocol The control system shall have interface and be able to communicate with several Open Industrial standard communications viz. HART, Profibus / Foundation Fieldbus, Modbus Serial / TCP-IP, ASI, OPC DA / OPC UA.
- n) Power supply 2 nos. 230V AC UPS input feeders (primary & secondary) shall be provided for each PLC / RIO panel.
Redundant power supply system for CPU, I/O system, interposing relays shall be provided. Power distribution shall be performed in such a way that any single power supply failure shall not cause loss of operation of any module.
A suitable power supply scheme for extending power through PLC to solenoids shall be devised and finalized during detailed engineering
230V AC power supply for PC / monitor & printer units shall be derived from dedicated feeders of the UPS ACDB. Surge protected power sockets shall be considered for powering the PC, monitor and printer units.

TECHNICAL REQUIREMENTS

- | | | |
|----|---|--|
| o) | Command hierarchy | Protection commands shall have priority over manual commands and manual commands shall prevail over auto commands. |
| p) | Temperature & humidity for continuous operation | 55 deg. C and 5% to 95% non-condensing humidity |
| q) | Time Synchronization system. | The PLC processor should be capable of receiving clock signals from Master Slave Clock system of the Owner in either NTP, DCF77 or IRIG-B format. |
| r) | System reaction time | Less than 100 msec. from input signal to output signal including logic processing. |
| s) | Display response | Max 1 sec for control related displays. 2 to 3 sec for other displays. |
| t) | Feedback / field interrogation | By 24V DC. Status feedback from MCC/field shall be in the form of one changeover contact. Discrepancy shall be alarmed. All analog signals shall be routed through analog cards. |
| u) | Programming functionalities | <p>The controller shall be function block based besides ladder logic complying with IEC 61131-3 standard for PLC programming languages. The programming language shall be based on object model approach, it should be user friendly with graphical user interface. All standard libraries of FBs as per IEC 61131-3 shall be provided.</p> <p>The controller platform shall have the ability to change configuration online while the system is running normally without stopping the process. Facility to simulate and test logic before on-line loading shall be available in the programming / configuration software.</p> |
| v) | HMIS (Human Machine Interface System) | <p>Operator shall be able to access all control / information related data under all operating conditions including a single processor / computer failure in the HMIS. The operator functions for each OWS shall as a minimum include Control System operation (A/M selection, raise/lower, set point/bias change, on/off, open/close operation, mode/device selection, bypassing criteria, sequence auto, start/stop selection, drive auto selection, local-remote/other multi-position selection etc.); alarm acknowledge; call all kind of displays, logs, summaries, calculation results, etc.; printing of logs & reports; retrieval of historical data; and any other functions required for smooth operation, control & management of information as finalized during detailed engineering.</p> <p>The system design shall provide for non-disruptive repairs of faulty equipment and on-line, non-disruptive system expansion in the field.</p> <p>The system shall support notification of a service disruption and recovery including computer name of failed server.</p> <p>Normal/Test/Program/Off facility shall be provided. In test mode all outputs shall be blocked. Manual intervention shall be possible at any stage of operation.</p> |
| w) | Long time storage & retrieval | Minimum 168 hours latest data on hard disc. |
| x) | Software | Industry standard operating system like UNIX/WINDOWS (latest version) etc. to ensure openness and connectivity with other system in industry standard protocols (TCP-IP/ OPC etc.) shall be provided. |

Contractor shall provide all system / application soft wares with locks and

TECHNICAL REQUIREMENTS

passwords for PLC operation meeting the intent, functional and parametric requirements of the specification. Complete set of documents for modifications / editing / additions/ deletions of features in software shall be provided. Comprehensive list of all application/ system software shall be provided.

- | | | |
|-----|--------------------------------------|--|
| y) | Accessories | Industrial grade furniture shall be provided along with Control desk / OWS / printer. |
| z) | Software license | The Contractor shall provide software license for all software being used in PLC based control system including HMI. The software licenses shall be provided for the project and shall not be hardware/machine specific. All licenses shall be valid for the continuous service life of the plant. |
| a1) | Software upgrades | As a customer support the Contractor shall periodically inform the designated officer of the Employer about the software upgrades / new releases that would be taking place after the system is commissioned and in service. |
| b1) | OWS / EWS & Printers | Operator work station (OWS) shall perform control, monitoring and operation of all auxiliaries / drives interacting with PLC based control system. It shall be possible to use the same system as EWS. The quantity of PCs, its associated peripherals and printers shall be finalized during detailed engineering. The minimum Technical specification requirements are as per Clause no. 2.04.00 of this chapter. |
| c1) | Remote I/O panels | Contractor shall provide Remote Input /Output modules housed in free-standing cabinets / racks (with suitable redundant datalink to the central PLC system) as finalized during detailed engineering. These Input / Output modules shall meet the technical requirements as mentioned in the above clauses and shall be designed to continuously work under the environment expected to be encountered in assigned areas without any air-conditioning support. Connectivity to the Central PLC shall be as per scheme approved during detailed engineering. These RIO panels shall be located in Air conditioned environment or otherwise the RIO Panels shall be provided with panel mounted ACs. |
| d1) | PLC system security & Cyber Security | The PLC system shall comply with IEC-62443 standards for Industrial Automation and Control System security. The system may preferably be Achilles level 2 / ISA Secure EDSA / Equivalent certified. |

2.03.00

Over and above the equipment and accessories required to meet the fully implemented system as per specification requirements, Control System shall have spare capacity and necessary hardware/ equipment/ accessories to meet following requirement for future expansion at site:

SPARE QUANTITY REQUIREMENT

- | | | |
|----|--|-------------------------------|
| 1. | Spare channels in input / output modules fully wired up to cabinets' TBs | 10% of as Engineered |
| 2. | Spare capacity in Processor / Controller to handle additional inputs / outputs of each type over and above implemented capacity. | 30% spare functional capacity |
| 3. | Spare relays & isolators of each type and rating mounted and wired in cabinets' TBs | 20% of as Engineered |

2.04.00

SPECIFICATIONS OF OWS / EWS

The minimum requirement of a PC based OWS / EWS shall be as indicated below, however the latest configuration (superior than that indicated below) available at the time of supply shall be provided.

Microprocessor: latest family of Intel core i7 with min 3.4 GHz with HD Graphics 4600
RAM : 16 GB 16000 MHz
Storage : 1 TB 7200 rpm 3.5" SATA drive

TECHNICAL REQUIREMENTS

Drive : 8 / 16 / Slim line x DVD+/-RW Drive
Network : Network card for supporting redundant link Ports :

- USB 3.0
- RJ 45 Network port
- Serial
- HDMI
- SATA 6Gb/s

Operating System: Windows Server 2016 / Win 10 Professional / Latest

Printer: Colour laser printer shall be suitable for A4 size paper, 4 page per minute, 600 dpi (black) and heavy duty (>= 30000 pages per month)

And all the peripheral for the EWS / OWS to work properly as intended such as keyboard, mouse KVM switches etc. shall be in the scope of the contractor. Each operator workstation shall be equipped with two 24" Flat LCD monitors.

Software requirement :- General MS Windows latest version, MS-Office, Microsoft Visual Studio, Adobe Acrobat Professional, Latest Anti-virus software & Application software - to suit project specific requirement.

2.05.00 FACTORY ACCEPTANCE TEST

FAT shall include Functional testing of software and hardware in accordance with the approved logic drawings and simulation of the system with switches, relays and solenoid valves etc. or equivalent loads. All other parametric tests as decided during detailed engineering shall be undertaken during FAT.

2.06.00 TRAINING

Further to the relevant clause regarding training specified elsewhere, Contractor's experienced personnel/engineers shall also provide training courses on offered PLC system to Employer's engineers in the following areas viz. Operator training, Hardware maintenance training, Software training, any other specialized training as required.

3.00.00 MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

3.01.00 Measuring instruments/equipment and subsystems offered by the Contractor shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.

3.02.00 All transmitters, sensors, switches and gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price.

3.03.00 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

3.04.00 (i) All instruments envisaged for sea water applications, shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by contractor).

(ii) For coastal areas, all instruments shall be provided with durable epoxy/polyurethane coating for housings and all exposed surfaces of the instruments.

(iii) For hazardous area, explosions proof enclosure as described in NEC article 500 shall be provided in instruments as applicable.

TECHNICAL REQUIREMENTS

3.05.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

3.05.01 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS

Minimum technical requirements shall be as follows:-

Microprocessor based 2 wire loop powered electronic transmitter with 4-20 mA DC HART output signal shall be provided. For calibration ranges greater than or equal to 400mmwc, **accuracy** of transmitter shall be ± 0.060 % of calibrated range(min), **stability** 0.25 % of calibrated range for 10 years and 50:1 **turn down**. For calibration ranges less than 400mmwc accuracy shall be ± 0.10 % of calibrated range (min) and 20:1 turndown. **Overpressure** rating of transmitter shall be 150% of maximum operating pressure.

Transmitter shall have weather proof IP-67 metallic housing with durable corrosion resistant coating, integral digital display with self-indicating diagnostics, plug and socket type electrical connection, calibration using HART calibrator, 2/3/5 Valve non integral manifold and rack with canopy.

For air and flue gas applications, DPT shall be provided for pressure measurement below range of 2000 mmwc. For corrosive, viscous, solid bearing, slurry type process fluids, suitable diaphragm seal shall be provided. Parts below seal shall be removable for cleaning. Entire volume shall be completely filled with inert liquid suitable for instruments. LVDT type transmitter is not acceptable.

3.05.02 RADAR TYPE LEVEL TRANSMITTER

Minimum technical requirements shall be as follows:-

Microprocessor based 2 wire type, HART protocol compatible, output signal 4-20mA along with superimposed digital signal (based on HART protocol), accuracy $\pm 0.5\%$ of calibrated span or minimum 5 mm, Load impedance 500 Ohm (minimum), weather proof IP-65 metallic housing with durable corrosion resistant coating, Plug in socket type electrical connection, zero & span adjustment- temper proof remote as well as local from instrument, integral digital display and self-indicating type diagnostic features, power supply 24V DC $\pm 10\%$, calibration using hand held HART calibrator. It should be possible to calibrate the instrument without any level in the tank/sump etc. All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.

In case of Guided wave radar (GWR) type level transmitters coaxial probe of SS316L shall be provided. However, Rod probe, cable probe of SS316L can be used for applications wherever coaxial probe is not suitable.

External cage and other mounting accessories shall be provided where ever side mounting is required. Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor.

Four wire type transmitters can be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.

For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.

3.05.03 TEMPERATURE TRANSMITTER (TT)

Single input temperature transmitter shall be 2-wire loop powered directly from 4-20mA input cards of DDCMIS. Transmitter shall be fully compatible with thermocouples and RTDs being provided. It shall be capable to handle Pt-100 RTD, Thermocouple –K, R & S types (selectable through HART terminal/calibrator).Temperature compensation

TECHNICAL REQUIREMENTS

for T/C shall be performed in the transmitter itself. In case of failure (open or burn-out) of RTD/thermocouple, transmitter shall provide low temperature output.

Transmitter shall be HART compatible, have EMC compatibility as per EN 61326, weather proof IP-67 metallic housing with durable corrosion resistant coating, plug and socket type electrical connection, integral digital display with self-indicating diagnostics, operating ambient temperature of 85 deg C without display & 70 deg C with display, suitable for 2 inch pipe mounting in enclosure/rack.

Composite Accuracy for RTD shall be $\leq 0.25\%$ of 0-250 deg C span, for T/C-K type $\leq 0.2\%$ of 0-600 deg C span and CJC accuracy (for thermocouples) shall be ≤ 1 deg C.

3.05.04 HART HAND HELD CALIBRATOR

Hand held calibrator with latest HART version shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of HART transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided for that specific type of transmitter.

3.06.00 Temperature Elements and accessories

K type (Chromel-Alumel) thermocouple, R type (Pt- Rhodium Pt) thermocouple, Pt100 (Platinum 100) type resistance temp detectors (RTDs) shall be provided for temperature measurement depending on temperature range meeting the following minimum technical requirements:-

(i) Swaged type Mineral insulated (magnesium oxide), SS316 sheathed, Duplex element, ungrounded separate junction, housing/head die cast aluminum IP65, plug in socket type electrical connection, Accuracy class 1 as per IEC-584/ ANSI-MC-96.1 for thermocouples & class A as per IEC-751/ DIN-43760 for RTDs.

(ii) Reference Standards : For Thermocouple : IEC-584/ ANSI-MC-96.1
For RTD : IEC-751/ DIN-43760
For Thermowell : ASME PTC-19.3

(iii) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.

(iv) The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.

(v) Thermo well (for all process temp. elements):- Shall be one piece solid bored type of 316 SS of step-less tapered design as per ASME PTC 19.3). Solid sintered tungsten carbide material shall be used for high abrasive medium. For Air & Flue gas applications protection tube with welded cap of 316 SS or better material shall be provided. For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges shall be provided.

3.07.00 FUEL GAS FLOW MEASUREMENT

Minimum technical requirements shall be as follows:-

Turbine type Gas flow meter shall be provided for individual Gas Engines. The accuracy of the flow meter shall be 1% at max. gas flow. The Gas Flowmeter shall be calibrated at NABL certified laboratory.

An electronic volume corrector for online pressure and temperature compensation shall be provided for each Gas Engine. Analog 4-20 mA signal corresponding to corrected

TECHNICAL REQUIREMENTS

Gas flow and totalized flow shall be available from the volume corrector and shall be wired to the PLC panel of individual Gas Engine.

However standard and proven practice of the contractor is also acceptable based on documentary evidence.

4.00.00 CONTINUOUS EMISSION MONITORING SYSTEM (CEMS): -

- (i) CEMS comprising of analysers and associated items for measurement of SO_x, NO_x, CO and O₂ measurement for compensation shall be provided for each Gas Engine by the Contractor for stack emission monitoring.
- (ii) Measurement of NO and NO₂ shall be done. Total NO_x values shall be reported as NO₂ i.e. $NO_x = NO + NO_2 = NO \times 1.53 + NO_2 = NO_x \text{ as } NO_2$.
- (iii) Oxygen (O₂) measurement in stack emission based on Paramagnetic/ Zirconia type instrument shall be provided by the Contractor for correction of SO₂, NO_x value corresponding to the standard/reference O₂.
- (iv) CEMS Parameters shall be normalized for temperature, pressure, moisture (applicable in case wet measurement techniques), etc. This facility shall be available in the respective analysers. Necessary measurement shall be provided by the Contractor for these parameters. All the CEMS parameters shall be reported on dry basis.
- (v) CEMS analysers for which dual ranges are specified shall be calibrated for range near to operating process value.
- (vi) Offered CEMS should be capable of operating unattended over the prolonged period of time.

The common requirements to be met for all types of analysers are as below. The specific requirements to be met by each type of analyser are detailed in the subsequent clauses.

4.01.00 Common Requirements for all Analysers

1.	Type	Microprocessor based with self-indicating type diagnostic feature. Output signal: 4-20 mA DC galvanically isolated. Digital signal transmission: RS232/ RS485 Modbus Protocol/ Ethernet TCP/IP protocol shall be provided in CEMS analysers for bidirectional communication of stack emission data to Employer's cloud server.
2.	Display	Digital display with reading in engineering units. Display of the measurement values as well as all the information required for checking/maintenance of the analyzer.
3.	Zero & span Adjustment	To be provided for all selectable ranges.
4.	Ambient temp.	0-50°C unless defined otherwise.

TECHNICAL REQUIREMENTS

5.	Analyser enclosure Type/Material	Weather protection for analyser mounted inside analyser panel shall be IP-22 or better. For all other analysers, weather protection class shall be IP-55.
6.	Calibration	Auto & Manual (from Remote). CEMS analyser should have inbuilt zero and calibration check capability.
7.	Power Supply	To be arranged by Contractor subject to Employer's approval.
8.	Others	<p>i) All interconnection tubing and cabling between probe and analyser / analyser panel and cabling from analyser/ analyser panel to DCS (in respective unit control room) are to be provided by Contractor.</p> <p>ii) All the calibration gases (certified cylinder) required for one year continuous operation shall be provided. The calibration gas container material shall not contaminate the calibration gas.</p>
9.	Location of probe	To be decided during detail engineering.
10.	Location of the analysers (other than insitu type)/Analyser Panel.	AT 0' Mtrs near stack for CEMS analysers except particulate matter analyser. For particulate matter preferred location is '0' meter near stack. Remote display cum configuration unit for particulate matter analyser should be provided at '0' meter near stack in the analyser panel in case particulate matter analyser is kept near the sample point due to technical limitation.
11.	Compliance to standards	USEPA, TUV, MCERTS or equivalent standards
12.	Type of Technology	<p>SO₂/NO_x :- Hot-extractive sampling type/ Dilution Extractive/ In-situ (Path) type</p> <p>CO :- Hot-extractive sampling type/ Dilution Extractive/ In-situ (Cross-duct) type. (can be combined with SO₂/NO_x)</p> <p>Note:- For Hot extractive sampling type and Dilution extractive sampling type system – The components involved in sample handling system shall be sourced from Original Analyzer Manufacturer (OAM) approved reputed suppliers having successful trouble free operation duly certified by Original Analyzer Manufacturer (OAM) & further, Sample handling system design shall be vetted by Original Analyzer Manufacturer (OAM). Necessary documents shall be furnished during detailed engineering in order to establish the above requirement. Technical expert of OAM shall witness testing of sample handling system and validate it. Alternatively sampling handling system assembled at Original Analyzer manufacturer (OAM) works shall also be accepted.</p>

4.02.00

Specific requirements for Hot-extractive sampling type SO₂, NO_x & CO analysers

Specification Requirements	SO ₂ Analyser and Nox Analyser cum monitor (combined)	CO Analyser
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TECHNICAL REQUIREMENTS

Type of Instrument	Sampling type - Hot Extractive type	Hot-extractive type
Principle of Measurement	Radiation absorption	NDIR absorption
Measurement Range	0-100 / 0-1000 mg/Nm ³ (selectable)	0-100/ 0-1000 mg/Nm ³ (selectable)
Accuracy	+/- 1% of lowest measurement range or better	+/- 1% of lowest measurement range or better
Linearity	≤ +/-1% of lowest measurement range	≤ +/-1% of lowest measurement range
Repeatability	≤ 1% of lowest measurement range	≤ 1% of lowest measurement range
Minimum detection limit	≤ 0.5% of lowest measurement range	≤ 0.5% of lowest measurement range
a) Temperature Drift	≤ +/- 2%/10 Deg.C	≤ +/- 2%/10 Deg.C
b) Zero Drift	≤ +/-1% of lowest measurement range /week	≤ +/-1% of lowest measurement range/week
e) Span Drift	≤ +/-1% of lowest measurement range /week	≤ +/-1% of lowest measurement range/week
Analyser Response time (up to 90% of full scale)	≤ 5 secs	≤ 5 secs
Operating Temperature Range for probe	0-300 deg.C	0-300 deg.C
Filter	Ceramic 3.5 Micron	Ceramic 3.5 Micron
Accessories for purging system	Purging system including Auto Scavenging facility shall be provided	Purging system including Auto Scavenging facility shall be provided
Sample gas inlet temperature to analyser	Temperature of the sample gas inlet to analyser shall be controlled before analyser as per manufacturer standards.	Temperature of the sample gas inlet to analyser shall be controlled before analyser as per manufacturer standards.

4.03.00 Specific requirements for Dilution Extractive type SO_x/NO_x & CO Analysers

The design of the Dilution Extractive type system shall be satisfying the following requirements. The sampling system shall consist of In-situ dilution probe, dilution probe controller, sample conditioning system like air drier and filters etc and other accessories

TECHNICAL REQUIREMENTS

meeting the following requirements as a minimum. All system components and accessories required for completion of this system shall be furnished although these may not be individually specified herein. Following are the minimum requirements:

- a) Modular Electronic Design.
- b) Heatless Air dryer with inlet filter, chemical scrubbers to remove traces of NOx/SO2 from air and accumulator.
- c) Self test facility with screen display.
- d) Protection of instrument in case ambient or surrounding temp going high beyond stipulated limit.
- e) The following are the minimum requirement for the probe:-
 - Flange and counter flange for inserting probe
 - Coarse and Fine filters
 - Critical orifice
 - Automatic blow back or purging facility
 - SS316L probe material
- f) Further dilution probe controller shall be provided with the ability to control dilution ratio
- (g) Unheated umbilical chord to be provided for transportation of the diluted sample, zero air, vacuum pressure, and calibration gas. This chord has to be a single bundle in FRLS PVC outer sheath. The sample line has to be of PTFE.

Specification Requirements	SO2 Analyser	NOx Analyser	CO Analyser
Principle of measurement	Pulsed/UV Fluorescence technology.	Chemiluminescence technology.	Gas Filter Correlation technology
Measurement Range	0-100 / 0-1000 mg/Nm3 (selectable)	0-100 / 0-1000 mg/Nm3 (selectable)	0-100/ 0-1000 mg/Nm3 (selectable)
Probe operating temp	0-300 deg C	0-300 deg C	0-300 deg.C
Accuracy	+/- 1% of lowest measurement range or better	+/- 1% of lowest measurement range or better	+/- 1% of lowest measurement range or better
Linearity	≤ +/-1% of lowest measurement range	≤ +/-1% of lowest measurement range	≤ +/-1% of lowest measurement range
Repeatability	≤ 1% of lowest measurement range	≤ 1% of lowest measurement range	≤ 1% of lowest measurement range

TECHNICAL REQUIREMENTS

Minimum detection limit	$\leq 0.5\%$ of lowest measurement range	$\leq 0.5\%$ of lowest measurement range	$\leq 0.5\%$ of lowest measurement range
Zero drift	$\leq \pm 1\%$ of lowest measurement range/week	$\leq \pm 1\%$ of lowest measurement range/week	$\leq \pm 1\%$ of lowest measurement range/week
span drift	$\leq \pm 1\%$ of lowest measurement range/week	$\leq \pm 1\%$ of lowest measurement range/week	$\leq \pm 1\%$ of lowest measurement range/week
Response time (up to 95% of full scale)	100 sec	60 sec	60 sec
Sample gas inlet temperature to analyser	5 deg.C - 40 deg.C	5 deg.C - 40 deg.C	5 deg.- 40 deg.C

4.04.00 Specific requirements for In-situ (Path) type SO₂, NO_x & CO analysers

Specification Requirements	SO ₂ /NO _x Analyser cum monitor	CO Analyser cum monitor
Principle of Measurement	Differential Optical Absorption Spectroscopy	IR absorption
Measurement Range	0-100 / 0-1000 mg/Nm ³ (selectable)	0-100/ 0-1000 mg/Nm ³ (selectable)
Accuracy	$\pm 1\%$ of lowest measurement range or better	$\pm 1\%$ of lowest measurement range or better
Linearity	$\leq \pm 1\%$ of lowest measurement range	$\leq \pm 1\%$ of lowest measurement range
Repeatability	$\leq 1\%$ of lowest measurement range	$\leq 1\%$ of lowest measurement range
Minimum detection limit	$\leq 0.5\%$ of lowest measurement range	$\leq 0.5\%$ of lowest measurement range
a) Temperature Drift	$\leq \pm 2\%/10$ Deg.C	$\leq \pm 2\%/10$ Deg.C
b) Zero Drift	$\leq \pm 1\%$ of lowest measurement range/week	$\leq \pm 1\%$ of lowest measurement range/week
e) Span Drift	$\leq \pm 1\%$ of lowest measurement range/week	$\leq \pm 1\%$ of lowest measurement range/week
Response time(up to 90% of full scale)	≤ 5 sec	≤ 5 sec
Probe Operating Temperature Range	0 to 300 deg C	0 to 300 deg C

TECHNICAL REQUIREMENTS

Accessories for purging system	Purging system to be provided with heavy duty blowers and shutter mechanism for automatic isolation of lens during purge air failure.	Purging system to be provided with heavy duty blowers and shutter mechanism for automatic isolation of lens during purge air failure.
Temperature compensation	Automatic temperature compensation to be provided	Automatic temperature compensation to be provided

NOTES:-

01. Hot extractive sampling type/ Dilution extractive type systems shall be provided with dual sample probes along with all required accessories such as redundant heavy duty pumps with continuous rated motors, moisture detection facility, pre-fabricated heated (for sampling type only) sample lines from probes to analyser panel, solenoid valves, filters, coolers along with level switch in gas coolers for auto draining purpose and flow meter etc as applicable. Alternatively, permeation based dryer (located near the tapping point) alongwith necessary sample conditioning devices to ensure full protection, to avoid clogging & long life of permeation tubes may also be provided in place of sample cooler. Also, healthiness status/alarm/indication of permeation based dryer shall be provided in analyser panel.
02. In case IR based technique is used for SO₂/NO_x measurement, correction for H₂O cross interference shall be available in the analyser.
03. If the SO_x, NO_x & CO (if sampling/dilution type) analyzers do not meet the environmental conditions specified in Part-A and/or Part-B Section VI, all weather Local Panel fitted with integral Air Conditioner located in non-air conditioned area shall be provided for housing analysers etc.
04. For O₂ Analyser, the construction of the sensor shall be such that joints between dissimilar materials are avoided to prevent formation of cracks.
05. For each Gas Engine, SO_x, NO_x and CO analyser may be provided as a single unit/combined unit meeting specification requirements.

4.07.00 Connectivity with PLC and provision for bidirectional communication with Employer's Cloud Server

1. 4-20mA signals from all the above analysers/ flow meters/ stack gas temperature ,, stack pressure, stack gas moisture, stack gas O₂ shall be wired to PLC
2. RS232/ RS485 Modbus protocol/ Ethernet TCIP/IP protocol for bidirectional communication with Employer's Cloud Server.

All the accessories and cables required for connecting Analysers outputs to DCS and provision of bidirectional communication as defined above shall be provided by Contractor on as required basis.

5.00.00 AMBIENT AIR QUALITY MONITORING STATION (AAQMS)

5.01.00 General Specifications for AAQMS

TECHNICAL REQUIREMENTS

- 5.01.01 The Analysers / Monitors should be 19" Rack Mounted with the ON / OFF switch and display of all important status signals including Lamps, etc should be preferably on the front panel.
- 5.01.02 The system must function properly in the weather and atmospheric conditions mentioned in Basic design Criterion, in view of ambient temperature, relative humidity and high dust levels for instruments / equipments housed in an enclosure.
- 5.01.03 The system should function without frequent servicing / maintenance. The parts requiring regular service / maintenance must be easily accessible.
- 5.01.04 All ambient Gas Analysers and Dust Monitor shall conform to the US EPA reference or equivalent method. A proof of approvals and certificates of the above compliance along with copy of the Test Report (in English) from internationally reputed agencies such as US EPA, TUV / UAB of Germany, Env. Canada, Env. Japan, EEC etc shall be furnished.
- 5.01.05 All Analysers shall be micro-processor controlled with automatic calibration. All Analysers, Monitors and Sensors should be fully integrated in the 19" Rack Cabinet, fully calibrated and tested before supply.
- 5.01.06 The vendor shall provide warranty for the entire system. as defined elsewhere in the Contract.
- 5.01.07 Three (3) Nos. of local AAQMS stations to be provided for the project. One (1) no. of local AAQMS station shall be installed in the plant premises. Location of other two (2) nos. of local AAQMS stations shall be decided during detail engineering. The quantity for AAQMS will be as follows:

Sl. No.	Ambient air quality monitoring system (AAQMS)	Quantity
1.	SO ₂ ANALYSER	03 Nos.
2.	NO _X ANALYSER	03 Nos.
3.	CO ANALYSER	03 Nos.
4.	SUSPENDED PARTICULATE MONITORS	06 Nos.
5.	SAMPLING INLET HEADS (PM 10, PM 2.5 AND TSP)	3 Sets for each type
6.	MULTI GAS CALIBRATION SYSTEM	03 Sets
7.	PC BASED DATA LOGGER FOR INDIVIDUAL AAQMS STATIONS	03 Nos.
8.	PC BASED DATA LOGGER FOR CENTRAL STATION WITH A4 LASER PRINTER	1 No.
9.	Wind Speed Sensor	1 No.
10.	WIND DIRECTION SENSOR	1 No.
11.	AIR TEMPERATURE SENSOR	1 No.
12.	RELATIVE HUMIDITY (RH) SENSOR	1 No.
13.	SOLAR RADIATION SENSOR	1 No.
14.	METEOROLOGICAL MAST	1 No.
15.	RAIN GAUGE	1 No.
16.	SAMPLE HANDLING SYSTEM	1 LOT

TECHNICAL REQUIREMENTS

17.	CONNECTIVITY FROM CENTRAL AAQMS STATION TO INDIVIDUAL STATIONS THROUGH WIRELESS LINK	1 LOT
18.	WINDOW A/C FOR EACH OF INDIVIDUAL AAQMS STATIONS (1.5 TONS EACH)	06 Nos.
19.	UPS FOR EACH INDIVIDUAL AAQMS STATION	03 Nos.
20.	UPS FOR PC BASED CENTRAL STATION	01 No.

5.01.08 Vendor shall give complete list of spares, consumables etc. along with their costs required for trouble-free operation.

5.01.09 The system shall be supplied with all ancillaries and consumables necessary for trouble free operation during the Warranty period. In case self-life of any consumable is shorter, such supplies to be done in suitable phases. Vendor shall give details of self-life, quantity of consumables required etc. to last the warranty period.

5.01.10 O&M Manuals shall be supplied in line with the general requirement indicated in sub-section GTR indicating details of installation, operation and calibration; preventive, routine & corrective maintenance.

5.01.11 A Sampling System compatible with the Analyzers / Monitors for Total Suspended Particulates (TSP), PM10, PM2.5, NOx, SOx, and CO shall be provided by the vendor. The system, wherever applicable, shall have the facility for moisture removal.

5.01.12 Minimum requirements like power supply, space, building, ventilation & approach road required for installation and commissioning of the AAQMS shall be specified by the vendor in the offer. Vendor shall obtain statutory and other clearances for purchase, commissioning and operation & maintenance of the AAQMS.

5.01.13 Vendor shall furnish, along with the bid documents, the details of calibration system provided with each Analyzer / Monitor.

5.01.14 In addition to connection with respective local data logger and central data logger as defined in subsequent clauses, AAQMS analysers shall have provision for bidirectional connectivity with Employer's central cloud server.

5.02.00 SPECIFICATIONS OF CONTINUOUS MONITORING AMBIENT AIR ANALYSERS

5.02.01 Oxides of Nitrogen (NO-NO2-NOX) Analyser

1.	Principle	Chemi-luminescence
2.	Measurement	NO, NO2, NOx in Ambient Air
3.	Display	LCD
4.	Ranges	0-1000 PPB in multi-ranges (minimum four selectable ranges) Preferably as below:
		0-100 PPB, 0-200 PPB, 0-500 PPB and 0-1000 PPB

TECHNICAL REQUIREMENTS

5.	Minimum Detectable Limit	1 PPB
6	Noise Level	0.5 PPB or less
7	Zero Drift at Lowest Range	<1PPB in 24 hours
8	Span Drift at Lowest Range	+ 2% in 7 days of full scale
9	Response Time at Lowest Range	2 minutes or less
10	Linearity	+ 1% of full scale
11	Calibration	Built-in Calibration Facility
12	Consumables and spares	Recommended requirements of 3 years of continuous operation
13	Digital Signal Transmission	RS 232 link. Analyser shall be capable to transfer all the data through RS 232 link to a PC based data logger.

5.02.02

Sulphur Dioxide (SO₂) Analyser

1.	Principle	UV Fluorescence
2.	Measurement	Sulphur Dioxide in Ambient Air
3.	Display	LCD
4.	Ranges	0-1000 PPB in multi-ranges (Minimum four selectable ranges) Preferably as below:
5.		0-100 PPB, 0-200 PPB, 0-500 PPB and 0-1000 PPB
6.	Minimum Detectable Limit	1 PPB
7.	Noise Level	0.5 PPB or less
8.	Zero Drift at Lowest Range	<1PPB in 24 hours with automatic zero Compensation.
9.	Span Drift at Lowest Range	+ 2% in 7 days of full scale

TECHNICAL REQUIREMENTS

10.	Response Time at Lowest Range	2 minutes or less
11.	Linearity	+ 1% of full scale
12.	Calibration	Built-in Calibration Facility
13.	Consumables and spares	Recommended requirements of 3 years Continuous operation
14.	Digital Signal Transmission	RS 232 link. Analyser shall be capable to transfer all the data through RS 232 link to a PC based data logger.

5.02.03 NOT USED

5.02.04 Continuous ambient air measurement of TSP, PM 10 & PM 2.5

	Principle	<p>The suspended Particulate Matter (SPM) Monitor for monitoring ambient air shall be based on the principle of beta attenuation by particulates sampled through the instrument and collected on movable filter tape. Before and after sampling, beta radiation shall be measured by appropriate counter. An internal microprocessor shall handle all sequences and automatically calculate the concentration of the particulate matter being measured. Contractor shall provide two nos SPM analysers in each AAQMS station for continuous measurement of suspended particulate matter. Each analyzer shall be designed for measurement of TSP, PM 10 & PM 2.5 so that any analyzer can be freely configurable at site for either TSP, PM 10 & PM 2.5. These analysers shall be provided with sampling heads suitable for continuous measuring of TSP and PM10. Additional sampling arrangement for PM 2.5 shall also be provided and it shall be possible to easily connect it to the Analyser normally measuring TSP.</p>
	Measurement	Continuous ambient air measurement of TSP, PM10 & PM 2.5.
	Sampling System	System for sampling of particulates of following sizes
		(a) Total Suspended Particulates (TSP)

TECHNICAL REQUIREMENTS

		(b) 10 microns or less.
		(c) 2.5 microns or less.
		The system shall have provision for removal of moisture from the sample, wherever applicable.
	Measurement Range	0-2000 microgram per cubic meter (microgram/m ³) in programmable multi-ranges
	Display	LCD
	Resolution	1% of the concentration
	Minimum Detectable Limit	2 micrograms/m ³
	Filter material	glass fiber filter
	Roll length	Approximately 30 meters
	Measurement result	1 hour average or shorter
	Digital Signal Transmission	RS 232 link. Analyser shall be capable to transfer all the data through RS 232 link to a PC based data logger.

5.02.05 Multi-Gas Calibration System

To cross check the built-in-calibration facility of the Analysers/Monitors, a standard Multi-Gas Calibration System for each AAQMS station with fast response time shall be offered by the Vendor for SO₂ and NO_x (Vendor to give complete details thereof) which can be used as manual or remote multi-point generation of gas concentrations from one to several high concentration Span Gas Cylinders. The Multi-Gas Calibration System shall meet the US EPA or TUV/UAB of Germany, Emt Canada, Emt Japan, EEC etc. requirements.

5.02.06 Carbon Monoxide (CO) Analyser

1	Principle	NDIR spectroscopy
	Measurement	CO
	Display	LCD
	Ranges	0-1 PPM to 0-1,000 PPM selectable.
	Minimum detectable limit	0.05 ppm
	Zero drift at lowest range	< 0.1 ppm/day

TECHNICAL REQUIREMENTS

	Span drift at lowest range	< 1% of reading per day
	Response time at lowest range	<60 sec.
	Linearity	1% of Full-Scale
	Precision	0.5% of reading
	Calibration	Built-in Calibration facility
	Consumable and Spares	Recommended requirement of 3 year continuous operation
	Digital signal transmission	RS 232 link. Analyser shall be capable to transfer all the data through RS 232 link to PC based Data logger.

5.03.00 SPECIFICATIONS OF METEOROLOGICAL SENSORS

5.03.01 Specifications of Wind Speed Sensor

1.	Principle	Frequency proportional to wind speed
2.	Range	0-60 m/ sec
3.	Accuracy	2 % of full scale
4.	Threshold	0.3 m/ sec
5.	Operating Temperature	0 to 50 deg C

5.03.02 Specifications of Wind Direction Sensor

1.	Principle	Potentiometric type Sensor (Resistance proportional to Wind direction)
2.	Range	0-360 deg
3.	Accuracy	2 % of full scale
4.	Threshold	0.3 m/ sec
5.	Operating Temperature	0 to 50 deg C

5.03.03 Specifications of Air Temperature Sensor

1.	Principle	RTD (Platinum) Resistance proportional to temperature
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TECHNICAL REQUIREMENTS

2.	Range	0-50 deg C
3.	Accuracy	+ 0.2 deg C
4.	Operating Temperature	0 to 50 deg C
5.	Radiation Shield	Non-aspirated Radiation Shield

5.03.04 Specifications of Relative Humidity (Rh) Sensor

1.	Principle	Thin film capacitance type sensor
2.	Range	0-100% RH
3.	Accuracy	3 % for range 10% to 90%
4.	Sensitivity	0.2% RH
5.	Operating Temperature	0 to 50 deg C
6.	Radiation Shield	Non-aspirated Radiation Shield

5.03.05 Specifications of Solar Radiation Sensor (Solarimeter)

1.	Principle	Thermopile/Thermo couple based with Appropriate Wind Shield
2.	Range	0.3 to 60 microns
3.	Measurement Range	0-1500 watt/m ²
4.	Accuracy	+ 3.5 %
5.	Operating Temperature	0 to 50 deg C

5.03.06 Specifications of Rain Gauge

Rain Gauge shall be of Self Recording Type and of reputed make & recording facility shall be provided in Electronics. The Gauge shall be rugged having material of construction resistant to atmospheric corrosion. The Instrument shall have automatic functions for computing rainfall for pre set time periods.

1.	Accuracy	+ 1 % to + 5% for rainfall rates Ranging from the lowest to 125 mm/hr or more
2.	Sensitivity	0.5 mm
3.	Operating Temperature	0 to 50 deg C

5.03.07 Meteorological Mast

One Meteorological Mast of telescopic type and of specified height to be placed on an existing structure (such as Buildings etc) so that height of the Meteorological Sensors from the Ground Level (GL) is 10 meters. The Mast is required for mounting the

TECHNICAL REQUIREMENTS

Meteorological Sensors. Necessary Hangers and Holders along with electrical Grounding Set shall be provided by the vendor for installation of the Sensors. Material of Construction of the Mast shall be metallic and robust and shall be resistant to atmospheric corrosion.

5.04.00 DATA LOGGER AT AAQMS & METEOROLOGICAL STATION

- a) There shall be one PC based Data Logger for each AAQMS and Meteorological Station. The entire data capture and mean value calculation as well as control of Analyzers should be through user-friendly software and operate on the latest Windows software system. Connection of Analyzers with serial Interface should be done through standard Connectors. Diagnostic features should be clearly indicated by the system and any unauthorized access should be protected by a pass word. PPB to micrograms per cubic meter (ug/m3) conversion factors should be part of the system.
- b) The Data Logger shall be provided with at least 8 Analog and 24 Digital Inputs and internal memory for all collected parameters. The Data Logger shall have ability to log Channels at different intervals and should have capability of averaging and displaying real time data and averaged data over selectable periods (minutes, hours, days, months and years) such as 1 min, 10 min, ½ hr, 1 hr., 4 hrs., 8hrs., 24 hrs., 1 month, 3 months, 6 months, year etc. It shall have adequate capability of connecting to all Analysers/ Monitors including the optional Analysers and Sensors for meteorological parameters.

5.04.01 Functional Requirements of Data Logger

1. Calculate vector mean of wind direction and wind speed
2. Graphic & tabular display of the current air quality monitoring data.
3. Generation of Wind Roses, Pollution Roses etc.
4. Data reports, calibration reports and status reports for user selectable time period (instantaneous or averaged over a period of ½ hr, 1 hr, 4 hrs, 8 hrs, 24 hrs, weekly, monthly or yearly).
5. Control panel window for controls of each Analyser, including calibration.
6. Alarm for all parameters.
7. Real time multi-curves/graphs over user selectable time period.
8. Historic multi-curves/graphs over user selectable time period.
9. Real time status and diagnostics for maintenance people.
10. Programmable down loading of data.
11. Diurnal variation, standard deviation, regression and other statistical parameter reporting possibilities with various available models.
12. Possibility to export the data files in other formats.

5.04.02 Central Station for AAQMS

There shall be separate Data Logger for the Central Station having configuration similar to the individual AAQMS. Location of central station shall be control room.

5.04.03 Data Communication System for The Central Station

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Data Communication system shall handle the data transmission of an ambient air quality network and receive incoming messages/ signals from remote Stations. The following additional features should be part of the system:

1. To collect all the data from the remote Stations at prescribed time or on request.
2. Manage at least 3 or more remote air quality-monitoring Stations.
3. Should have the remote control facilities for calibrations (Zero & Span) and Measuring Range.
4. Should display multiple Stations on-line data (momentary values) in tabular text and graphic format.
5. Should connect the remote stations through Wireless Communication link.

5.04.04 Additional features of the Data Logger at Central Station

1. Data Management, analysis and reporting
2. Latest Microsoft Windows operating System
3. 32 bit application
4. Data collection from remote stations via Data communication Server
5. Inter-comparison of data between monitoring stations
6. Comparison of data of various parameters for the same monitoring station.
7. Integrates charts, tables and graphics.
8. Should support primary and secondary mean values of user defined time interval.
9. Should have data backup facilities
10. Should have the facilities for calculation of Arithmetic mean values, average $\frac{1}{2}$ hr, 1 hr, 2 hrs, 3 hrs, 4 hrs, 8 hrs, 12 hrs, 24 hrs, weekly monthly and yearly
11. Minimum, Median, percentile, Maximum, standard deviation frequency analysis and cumulative frequency analysis
12. Calculation of pollution load and Wind Roses
13. Reports of daily, weekly, annual and user defined period
14. Reports of Pollution load and Wind Roses, frequency analysis, and calibration
15. Should have the facilities of the following chart types:
 - Line & column chart
 - Simple 3 D, line & column chart
 - Polar diagram and 3 D perspective column chart

5.04.05 Data Communication System

Each AAQMS station shall be connected to Central data Acquisition station through a two way wireless communication link. This shall allow for wireless transmission of data periodically to individual and central DAS & do the necessary communication between stations. Contractors shall determine the optimal antenna type required to achieve data transfer rate between all wireless access points. Contractor shall use for this purpose, approved and standard equipment like antennas and/or amplification

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devices etc required to achieve the above and shall provide agreement of technical support and support availability.

Connectivity & transmission of data to CPCB/SPCB or customer DAS is in bidder's scope.

Contractor shall obtain necessary approval for Licenses authorizing the use of communication equipment specified frequencies.

6.00.00 **POWER SUPPLY SCHEME**

6.00.01 **General Requirements**

The functional requirements of Electrical Power Supply system are specified herein, Contractor shall be responsible for engineering and furnishing a complete, operational and reliable system fully meeting the intent and requirements of this specification. Employer approved drawings during detailed engineering and operational requirements of the system offered by the Contractor. All equipment and accessories required for completeness of this system shall be furnished by the Contractor whether these are specifically mentioned herein or not. All the equipment's and sub systems offered shall be from reputed experienced manufacturers. Complete System shall be manufactured, assembled, wired and fully tested as a complete assembly as per the requirements of this specification at the OEM/manufacturer's works.

6.01.00 **POWER SUPPLY SYSTEM (UPS SYSTEM)**

Contractor shall provide UPS of suitable capacity for meeting the requirements of Technical Specifications. Contractor shall provide power supply distribution panels/cabinets/boxes for sub distribution of DC/Main UPS/Utility feeders on as required basis. The power supply distribution box shall include change over circuitry, switch fuse units, MCBs, terminal blocks etc. suitable for application.

6.01.01 The UPS Power Supply for various systems shall consist of one or more of the following configurations.

Contractor shall clearly bring out in the proposal the redundancy feature along with configuration diagram, single line diagram and data sheets etc. & this shall be finalized subject to employer's approval during detailed engineering. The offered system design shall be tolerant towards single fault.

UPS system shall consist of 1 x 100% charger and inverter, 1 x 100% Ni Cd Battery Bank for 1 hour, Bypass Line Transformers and Voltage Stabilizer, static switch, manual bypass switch, 2 x 100% ACDB, 1x100% Microprocessor controlled Battery Health Monitoring System (BHMS) and other necessary protective devices and accessories.

UPS System shall meet the following minimum functional requirements:

(a) UPS KVA shall be guaranteed at 50 Deg C.

(b) The charger should be capable to fully charge the required batteries as well as supply the full rated load through inverter. Furthermore the charger should be able to re-charge the fully discharged battery within 8 hours.

(c) The charger output regulation shall be $\pm 1\%$ from no load to full load with an input power supply variation of $\pm 10\%$ in voltage and $\pm 5\%$ in frequency.

(d) The minimum full load efficiency at nominal input and output shall be 90%. The ripple content shall be limited to $\pm 2\%$ of Charger output voltage.

(e) The UPS system shall be capable of operating without D.C. battery in circuit under all conditions of load and the performance of various components of UPS like inverter,

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charger, static switch etc. shall be guaranteed without the battery in circuit.

(f) The UPS system design shall ensure that in case of failure of mains input power supply to one of the chargers, the other charger whose mains input power supply is healthy, shall feed to one or both the inverters as the case may be as per manufacturer's standard practice & continue to charge the D.C. battery at all load conditions. The Contractor should note that this situation should not in any way lead to the discharge of the D.C. Battery.

(g) The static inverter shall be of continuous duty, solid state type using proven Pulse Width Modulation (PWM)/Quasi square wave/step wave technique.

(h) The inverter efficiency shall be at least 85% on full load and 80% on 50% load.

(i) The steady state voltage regulation shall be +/-2% and transient voltage regulation (on application/removal of 100% load) shall be +/-20%. Time to recover from transient to normal voltage shall not be more than 50 mSec.

(j) Static & Manual Bypass Switches and SCVS to be provided.

(k) Redundant AC feeders (one from each ACDB) shall supply each of the connected panels. However, 25% spare feeder (min. 1 no.) with fuses for each rating shall be provided in each ACDB.

(l) The batteries shall be heavy duty Nickel-cadmium type and shall be sized for one hour of full load operation during non-availability of AC supply / chargers. The Ni-Cd batteries shall conform to IS: 10918.

7.00.00 PROCESS CONNECTION PIPING

Process connection & piping including LIE / LIR, all impulse piping, pneumatic piping/tubing, valves, valve manifolds, fittings and all other accessories shall be provided on as required basis for proper installation & completeness of impulse piping system and air supply system.

The Contractor shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this Sub-Section and QA sub section requirements on as required basis for the connection of all instruments and control equipments of entire plant. Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.

7.01.00 IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS

The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:

Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Pr. Class, Size)	ASME 16.34
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70

The material for Impulse pipes and associated fittings shall be SS304 or better. Seamless Tube, fittings of SS316 shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:

Manifold	Application/Measurement
2 Valve	Pressure measurements using pressure transmitters/pressure switches
3 Valve	Pressure measurements using differential pressure transmitter/switches
5 Valve	Differential Pressure, Flow and Level Measurements

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For protection against sea environment all impulse pipes, fittings etc. shall be provided with durable epoxy coating with poly urethane finish.

All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc. Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of dirty air and flue gas applications.

8.00.00 INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL (CABLE SUB-TRAYS ETC)

a) All instrumentation cables (twisted & shielded, FRLS PVC insulated and sheathed), data highway / fibre optical cables including prefabricated cables (with plug-in connectors), cables as applicable for direct interconnection of two equipment/ system/ devices in Contractor's scope as well as for connection of signals from/to systems like MCC/LT SWGR/HT SWGR/ etc. shall be provided by Contractor on as required basis.

b) All power supply distribution cables required for directly connecting two equipment / systems devices in contractor's scope shall be provided by the contractor. All these cables shall be FRLS & as per IS-1554 Part – I latest edition.

c) Above cables shall be provided along with necessary laying & termination accessories, hardware etc. All sub trays along with supporting, connecting hardware etc. required for laying of instrumentation, control, power and other cables etc. up to main cable trays are under Contractors scope.

d) Junction boxes with requisite terminals shall be provided on as required basis.

8.01.00 General requirements

8.01.01 All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Contractor shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.

8.01.02 The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope and ensuring completeness of the control system.

8.01.03 Other type of cables like fiber optic/co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) are also to be furnished by the Contractor.

8.01.04 Contractor shall supply all cable erection and laying hardware from the main trunk routes like branch cable trays/sub-trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.

8.01.05 Wherever the quantity has been defined as on as required basis, the same are to be furnished by contractor on as required basis within his quoted lump sum price without any further cost implication to the Employer.

8.02.00 SPECIFICATION OF INSTRUMENTATION CABLE

8.02.01 Common Requirements

S. No.	Property	Requirement
1	Operating Voltage	225 V (peak value)

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S. No.	Property	Requirement
2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IEC 60584, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.
3.	Continuous operation suitability	At 205 Deg C for Type-C cables & heat resistant cables, at 70 Deg C for all other type of cables.
4.	Marking :-	<p>a. <i>Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath.</i></p> <p>b. Marking to read 'FRLS' to be provided at every 5 meters on outer sheath except for Type-C cable</p> <p>c. Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.</p>
5.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
6.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
7.	Ovality at any cross-section	Not more than 1.0 mm
8.	Color	The outer sheath shall be of blue color except for KX & SX extension cables. For KX & SX extension cables color of outer sheath shall be as per ANSI MC 96.1/ IEC 60584.
9.	Others	Repaired cables shall not be acceptable.

8.02.02

Specific Requirements

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
A. CONDUCTORS				
Cross section area	0.5 sq. mm			
Conductor material	Type KX as per ANSI MC 96.1/ IEC 60584	Type SX as per ANSI MC 96.1/ IEC 60584	Annealed bare copper	
Colour code	As per ANSI MC 96.1/ IEC 60584	As per ANSI MC 96.1/ IEC 60584	As per VDE-815	
Conductor Grade	As per ANSI MC 96.1 / IEC 60584		Electrolytic	
No & dia of strands	7x0.3 mm (nom)			

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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
No. of Pairs	2	2	2/4/8/12/16/24/48	
Max. conductor loop resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4	
Reference Standard	As per ANSI MC 96.1/ IEC 60584		VDE : 0815	
B. INSULATION				
Material	Extruded PVC type YI 3			
Thickness in mm (Min/Max)	0.25/0.35			
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.			
C. PAIRING & TWISTING				
Max. lay of pairs (mm)	50			
Single layer of binder tape on each pair provided	Each core printed with number or Numbered binder tape to be provided on each pair	Yes		
Bunch (Unit Formation) for more than 4P	N.A	To be provided		
Conductor /pair identification as per VDE0815	N.A.	To be provided		
D. SHIELDING				
Type of shielding	Al-Mylar tape			
Individual pair shielding	No	To be provided for F-type cable		
Minimum thickness of Individual pair shielding	No	0.028mm (28 micron)		
Overall cable assembly shielding	To be provided			
Minimum thickness of Overall cable assembly shielding	0.055 mm (55 micron)			
Coverage / Overlapping	100% / 20%			

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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable
Drain wire provided for individual shield	N.A.		Yes (for F-type) Size- 0.5 sqmm No of strands-7 Dia of strands- 0.3mm Annealed Tin coated copper
Drain wire provided for overall shield	Yes, Size- 0.5 sqmm, No of strands-7, Dia of strands- 0.3mm, Annealed Tin coated copper		
E. FILLERS (if applicable)			
Non-hygroscopic, flame retardant	To be provided		
F. OUTER SHEATH			
Material	Extruded PVC compound YM1 with FRLS properties		
Minimum Thickness at any point	1.8 mm		
Nominal Thickness at any point	>1.8 mm		
Resistant to water, fungus, termite & rodent attack	Required		
Minimum Oxygen index as per ASTM D-2863	29 %		
Minimum Temperature index as per ASTM D-2863	250 deg.C		
Maximum Acid gas generation by weight as per IEC-60754-1	20%		
Maximum Smoke Density Rating as per ASTM D-2843	60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTM D-2843)		
Reference standard	VDE207 Part 5, VDE-816		

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Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
G. Electrical Parameters				
Mutual Capacitance Between Conductors At 0.8 Khz (Max.)	200 nF/km		120 nF/km for F type and 100 nF/km for G-type	
Insulation Resistance (Min.)	100 M Ohm/Km			
Cross Talk Figure (Min.) At 0.8 Khz	60 dB		60 dB	
Characteristic Impedance (Max) At 1 Khz	N.A.		320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	
Attenuation Figure At 1 Khz (Max)	N.A.		1.2 db/km	
H. COMPLETE CABLE				
Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			
Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification			

8.03.00 SPECIFICATION OF OPTICAL FIBER CABLES (OFC)

- 8.03.01 Optic Fiber cable shall be 4/8/12 core, Electrolytically chrome plated corrugated steel taped (ECCST), fully water blocked with dielectric central member for outdoor/indoor application so as to prevent any physical damage. The cable shall have multiple single-mode or multi mode fibers on as required basis so as to avoid the usage of any repeaters. The outer sheath shall have Flame Retardant, UV resistant properties and are to be identified with the manufacturer's name, year of manufacturer, progressive automatic sequential on-line marking of length in meters at every meter.
- 8.03.02 The cable core shall have suitable characteristics and strengthening for prevention of damage during pulling viz. Dielectric central member, Loose buffer tube design, 4 fibers per buffer tube (minimum), Interstices and buffer tubes duly filled with Thixotropic jelly etc. The cable shall be suitable for a maximum tensile force of 2000 N during installation, and once installed, a tensile force of 1000 N minimum. The compressive strength of cable shall be 3000 N minimum & crush resistance 4000 N minimum. The operating temperature shall be -20 deg. C to 70 deg. C
- 8.03.03 All testing of the fiber optic cable being supplied shall be as per the relevant IEC, EIA and other international standards.
- 8.03.04 Contractor to ensure that minimum 100% cores are kept as spares in all types of optical fibre cables.
- 8.03.05 Cables shall be suitable for laying in conduits, ducts, trenches, racks and under ground

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buried installation.

8.03.06 Spliced / Repaired cables are not acceptable.

8.03.07 Penetration of water resistance and impact resistance shall be as per IEC standard.

8.04.00 OFC AND UTP/STP CABLE INSTALLATION AND ROUTING

8.05.00 CABLE LAYING AND ACCESSORIES

8.05.01 CABLE LAYING

Optical fiber cables (OFCs) :

Outside Building Area - to be laid necessarily inside GI conduit with support from cable tray/Trestle structure

Inside Building Area – to be laid on separate cable sub-trays

While buried- in separate buried trench approx.1.0 meter depth, to be laid in 2" rodent proof HDPE conduits covered with sand, brick, laid breadth-wise and soil along the pipe line route by contractor;

While crossing roads - to be laid in GI/ rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;

While crossing canals/river- to be laid in rodent proof HDPE conduits within hume pipe.

Laying of Network Cable (UTP/STP) :

Out side Building Area- to be laid necessarily inside GI conduits with support from cable tray / Trestle structure.

Inside Building Area- to be laid necessarily inside GI conduits on separate cable sub-trays.

8.05.02 Contractor shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.

8.05.03 The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.

8.06.00 FIELD MOUNTED LOCAL JUNCTION BOXES

Material & thickness - Fiberglass Reinforced Polyester (FRP) of 4 mm (minimum thickness. Terminal blocks - Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm².

Other requirements – Earthing stud, Weather & dust proof IP-65, Suitable for mounting on walls, columns, structures, brackets, bolts, nuts, screws, glands required for erection shall be of SS

8.07.00 CONDUITS

8.07.01 Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant **terne coated steel** with , water leak, fire and rust proof protected.

And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.

8.07.02 All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit

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supplied.

8.07.03 Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.

8.07.04 Conduits shall be securely fastened to all boxes and cabinets.

8.08.00 CABLE SUB-TRAY & SUPPORT

8.08.01 The cable sub-trays and the supporting system, to be generally used between Local/Group JB's and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).

8.08.02 The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded.

9.00.00 TYPE TESTS

(a) All equipment to be supplied shall be of type tested quality. The Contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

(b) However if the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract, at no additional cost to the Employer either at third party lab or in presence of clients/Employers representative and submit the reports for approval

(c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

(d) The type test reports once approved for any projects shall be treated as reference. For subsequent projects if NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No Design Change." Minor changes if any shall be highlighted on the endorsement sheet.

9.01.00 TYPE TEST REQUIREMENT - PLC

9.01.01 Following test reports shall be submitted for the equipment in line with IEC / EN 61131-2 / relevant IEC / EN standard:

- a). Dry heat withstand test as per IEC 60068-2-2 or equivalent
- b). Variation of temperature immunity test
- c). Variation immunity test
- d). Temperature cycle test
- e). Noise immunity test
- f). Dielectric test.

10.00.00 CONTROL VALVES & ACCESSORIES

Control valves and accessories, shall be provided on as required basis to meet the functional and the other specification requirements.

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10.01.00 General Requirements

10.01.01 The control valves and accessories equipment furnished by the Contractor shall be designed, constructed and tested in accordance with the latest applicable requirements of code for pressure piping ANSI B 31.1, ISA and other standards specified elsewhere as well as in accordance with all applicable requirements of the "Federal Occupational Safety and Health Standards, USA" or acceptable equal standards.

10.02.00 CONTROL VALVE SIZING & CONSTRUCTION

10.02.01 The design of all valve bodies shall meet the specification requirements and shall conform to the requirements of ANSI (USA) for dimensions, material thickness and material specification for their respective pressure classes.

10.02.02 The valve sizing shall be suitable for obtaining maximum flow conditions with valve opening at approximately 80% of total valve stem travel. Further, the valve stem travel range from minimum flow condition to maximum flow condition shall not be less than 50% of the total valve stem travel. While deciding the size of valves, Contractor shall ensure that valves trim outlet velocity are within limits as defined in ISA handbook for Control Valves.

10.02.03 Control valves shall have leakage rate as per leakage Class-V. The control valve induced noise shall be limited to 85 dBA at 1 meter from the valve surface under actual operating conditions.

10.03.00 VALVE CONSTRUCTION

All valves shall be of globe /Butterfly body design & straightaway pattern with single or double port, unless other wise specified or recommended by the manufacturer to be of angle body type. Rotary valve may alternatively be offered when pressure and pressure drops permit. Cast Iron valves are not acceptable.

All valves connected to vacuum on down stream side shall be provided with packing suitable for vacuum applications (e.g. double vee type chevron packing). Valve characteristic shall match with the process characteristics. Flanged valves shall be rated at no less than ANSI press class of 300 lbs.

10.04.00 VALVE ACTUATORS

All Control Valves shall be furnished with Pneumatic Actuators. The valve actuators shall be capable of operating at 60 deg.C continuously.

An adequate allowance for stem force, at least 0.15 Kg/sq.cm. per linear millimeter of seating surface, shall be provided in the selection of the actuator to ensure tight seating unless otherwise specified. The travel time of the pneumatic actuators shall not exceed 10 seconds.

10.05.00 CONTROL VALVE ACCESSORY DEVICES

All pneumatically actuated control valve accessories such as air locks, hand wheels/hand-jacks, limit switches, Microprocessor based Positioner, diffusers, external volume chambers, position transmitters (capacitance or resistance type only), reversible pilot for Positioner, tubing and air sets, solenoid valves and junction boxes etc. shall be provided as per the requirements.

10.06.00 SPECIFICATIONS FOR MICROPROCESSOR BASED POSITIONERS

Microprocessor Based Electronic Positioner is to be provided on as required basis with all the Control valves and all control dampers being provided by the contractor.

Microprocessor based positioners should be loop powered by control system, HART compatible, should have following features:

1	Environment	a) Operating Temp	(-)30 To 80 Deg. C

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		b) Humidity	0-95 %
		c) Protection Class	IP-65 Minimum
2.	Fail Safe/Fail Freeze	Fail safe/Fail freeze feature is to be provided.	
3	Performance	Characteristic Deviation	<=0.5 % Of Span
		Ambient Temp Effect	<=0.01 %/Deg C Or Better
4	EMC & CE Compliance	Required To International Standard Like EN/IEC.	En50081-2& En50082 Or Equivalent

11.00.00 Electric Actuator (ON/OFF & Inching Type):

Non-intrusive Hardwired Electric actuators with integral starters along with associated accessories etc shall be supplied on as required basis compatible for all Valves / Dampers to meet the functional and the other specification requirements. The actuators shall be totally enclosed weatherproof with IP-68 degree of protection. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication for actuator alarms, status, valve position indication and diagnostic information shall be available integral to actuator body.

415 V, 3 phase 3 wire power supply shall be given to the actuator from switch board as applicable through a switch fuse unit. The motor shall be squirrel cage induction motor, class F insulated suitable for Direct On Line (DOL) starting. Single Phasing Protection, over heating protection through Thermostat (as applicable) and wrong phase sequence protection shall be provided over and above other protection features standard to Contractor's design.

The Position/ Limit measurement shall be done using absolute encoders which will give information of position/ limit in both the directions. Electronic measurement of torque shall be provided. Open/Close command, open/ close status and disturbance monitoring signal (common contact for Overload, Thermostat, control supply failure, L/R selector switch at local & other protections operated) shall be provided hardwired. All actuators shall be certified for SIL 2 or better. Further, 10% or min 2. configuration/ diagnostic tool (if applicable) for non-intrusive actuators shall be provided for complete package.

12.00.00 MASTER CLOCK

The Contractor shall provide a GPS based date insensitive master and slave clock system (common for the station) with adequate number of output signal to provide uniform timing throughout the various plant facilities supplied by Contractor. The system shall be complete with receiving antennae (for receiving time from GPS or Radio signal), receiver and associated electronics, Redundant Master Clocks, Slave Clocks, interconnecting cables, cubicles, power supplies & any other accessories. However, a provision shall be kept for synchronisation of the master clock with other source as decided during detailed Engineering. The exact format/type of synchronization of master clock with other sources & slave/other system with master clock shall be finalized during detailed Engg. Stage.

13.00.00 CLOSED CIRCUIT TELEVISION (CCTV) SYSTEM

Minimum 20 nos. of CCTV cameras shall be provided by the Contractor. Location of the CCTV cameras shall be decided during detailed engineering.

TECHNICAL REQUIREMENTS

13.01.00 General Requirements

The intent of the specification is to define the functional & design requirements for the CCTV System meant for gathering video information from the various areas of the power plant with display and recording facilities with night vision and motion sensors as per requirement.

- 13.01.01 The Contractor shall be responsible for selection, design, engineering, manufacture, testing at manufacturer's works/site, installation of all the equipments supplied as covered in this specification and commissioning of the system meeting the intent & functional requirements of the specification. All the power supply (UPS), cables, cable trays, power packs, erection hardware (viz. junction boxes, brackets glands, nut-bolts, conduits etc.) and mounting are also included in Contractor's scope.
- 13.01.02 The Contractor's scope shall also include successful demonstration of functional requirements specified herein complete in all respects.
- 13.01.03 The Contractor shall guarantee satisfactory performance of the equipment under stipulated variations of voltage and frequency.
- 13.01.04 The design and manufacture shall be such that equipment / components of same type and rating are interchangeable.
- 13.01.05 The number of camera units, servers, network switches, wireless equipment etc. and their locations shall; be finalized during detailed engineer for effective functional requirements.
- 13.01.06 Any other equipment, module, software required for the safe and satisfactory operation, control, protection, monitoring, testing and maintenance of the system shall also be included by the Contractor within the lump sum quoted price.
- 13.01.07 The equipment furnished under this section shall meet the requirements of all the applicable International codes and standards or their latest amendment Codes and Standards. Camera certification has to be CE/FCC/UL or equivalent.

13.02.00 POWER SUPPLY ARRANGEMENT

- 13.02.01 The CCTV System along with all its components i.e. network switches, storage devices, servers, LAN switches, cameras etc. shall be powered from UPS system. Contractor shall also provide local power distribution boxes as required for sub-distribution of UPS supply.
- 13.02.02 For cameras to be located in remote areas where the UPS power supply can not be extended due to voltage drop etc., then such cameras can be grouped and fed from mini UPS. Individual mini UPS shall be provided for the cameras which can not be grouped. Mini UPS are to be provided by the contractor within his quoted lumpsum price. Contractor shall also provide local power distribution boxes as required for sub-distribution of supply from these mini-UPS to cameras. The location of mini-UPS & power distribution scheme shall be finalized during detail engineering.
- 13.02.03 If the offered equipment is operating at voltage level other than what is available as auxiliary supply, the Contractor shall provide all required hardware, to make the offered system compatible with specified power supply arrangement.

13.03.00 DESIGN AND TECHNICAL REQUIREMENTS

TECHNICAL REQUIREMENTS

- 13.03.01 The CCTV system shall be able to provide surveillance of different locations in the plant, entry gate and all across periphery. The exact locations shall be decided during detailed engineering.
- 13.03.02 The CCTV system shall be designed as a standalone IP based network architecture. System shall use video signals from different cameras at different locations, process the video signals for viewing on monitors at different locations and simultaneously record all the video streams using H.264 or better compression technique. Joystick and mouse-keyboard controllers shall be used for Pan, Tilt, Zoom and other functions of desired cameras.
- 13.03.03 The monitoring of these cameras shall be done at main Control Room or as finalized in detailed engineering. The required no. of hardware/software licenses to meet the requirements shall be supplied by the contractor.
- 13.03.04 Camera and database servers shall offer both video stream management, video stream storage management. These servers shall also manage and store configuration information/database for the whole system. Recording frame rate & resolution in respect of individual camera shall be programmable. It shall be possible to view and record at different resolutions and frame rates and this shall be individually programmable on every camera.
- It shall be possible to take back-up of system configuration and database on portable media device and restoring the same if required.
- 13.03.05 System shall ensure that once recorded, video can not be altered.
- 13.03.06 Camera server shall be provided with sufficient storage space to store recordings of all cameras at 25/30 FPS at 1920X1080, 100% activity level, for a period of Fifteen (15) days or more using necessary compression techniques. All recordings shall have camera ID, Location, Date and time of recording.
- 13.03.07 It shall be possible to view, record, search and replay simultaneously without affecting performance of the system.
- 13.03.08 The system supplied shall be complete in all respects for reliable performance. The Contractor shall submit the detailed block schematic, video, signal & power wiring diagram, describing the connections between the network switch/camera server Systems and various cameras, monitors, keyboard, and joystick.
- 13.03.09 The camera & Video Management Software shall conform to ONVIF profile S or latest available applicable ONVIF profile at the time of detail engineering.

13.04.00 DETAILED DESCRIPTION OF THE SYSTEM COMPONENTS:

13.04.01 Application Software for Video Monitoring, Recording & Management.

- a) The application software shall be used to display, store, control & manage the entire surveillance system.
- b) It shall be possible to control all cameras i.e. PTZ, auto/manual focus, selection of presets, video tour selection etc. The software shall support flexible 1/2/4 windows split screen display mode or scroll mode on the display monitors for live video.
- c) The system shall support video analytics in respect of the following
 1. Video motion detection,
 2. Object tracking
 3. Object classification & Tracking

The feature can be an integral part of camera or a part of camera server. The features shall be user configurable for each camera. It shall be possible to activate recordings automatically based on events generated by video analytics. These events shall also be logged and suitably alarmed on the monitors.

TECHNICAL REQUIREMENTS

13.04.02 Cameras:

a) All the cameras shall be color, suitable for day and night surveillance and network compatible. PTZ cameras shall be high speed integrated dome type.

Camera shall be directly connected to network and use of external encoder for connecting to network is not acceptable. The cameras shall be rugged, high performance color cameras. These cameras shall provide high resolution and high sensitivity suitable for operation in a power plant, both in natural and artificial lighted areas.

b) Detailed technical specification is given below.

PTZ Dome Cameras

High Definition (HD) PTZ cameras

Image Device	1/2.8-1/3" Progressive scan CMOS
Lens	4.45-4.7 /89-94.0 mm focal length
Optical Zoom	20x or better
Digital Zoom	12x or better
Number of Pixels/Effective resolution	1920X1080 (Full HD)/2 MP at 25/30 IPS
Video compression	H.264 Main Profile/High profile
Sensitivity	color mode 0.6 lux , B/W mode 0.04lux @30IRE, F1.6
Horizontal Angle of view	55.4 deg(wide)- 3.5 deg (Tele) minimum
Focus	Auto with Manual Override
Iris Range	F1.6-F2.9
Iris Control	Auto with Manual Override
Back Light Compensation	Required
White Balance	Automatic with mode selection options
Electronic Shutter	1/50 to 1/10000 Auto
S/N Ratio	>50dB
Audio	Full Duplex or 2-way
Automatic Gain Compensation	Up to 18 dB
Power Supply	The camera power supply should be of the same make as that of camera and suitable for the model no. offered.
Gain Control	Auto/Off
Day/Night selection	Auto On-Off
IR cut-filter	Yes
Protocols	IPV4/IPV6,RTP, UDP, TCP, IP, HTTP, HTTPS, FTP, DHCP, IGMP V2/V3, ICMP, ARP, SMTP, SNTP,SNMP or equivalent.
Security	Password protection
Auto Resume after Power Failure	Yes
Multiple Streams	H.264 /H.264 & H.264/Motion JPEG
Operating resolution	Primary stream – 1920X1080 at 25/30 FPS & other minimum 720X576 at 25/30FPS
Analytics	Motion detection & Tamper alarm
PoE supply IEEE 802.3af compliant or better	Yes
Rate Control	VBR/CBR
Other Features	
	On screen Menu display, contour correction and contrast compensation control

TECHNICAL REQUIREMENTS

	Automatic Picture Enhancement to give a balanced picture where there is too much/too little light
	Synchronization selection for line lock and free running
	Minimum 2 Alarm I/Ps & 1 alarm output
PTZ Specifications	
Pan	360 Deg Continuous
Tilt	90 deg
Manual Tilt Speed	0.1 deg/sec to 45 deg/sec
Manual Pan Speed	0.1 deg/sec to 80 deg/sec
Preset Positions	Minimum 256
Preset Pan Speed	280 deg/sec min
Preset Tilt Speed	160 deg/sec min

13.04.03 Camera Housing & Mount

a) All the cameras and accessories are to be housed in Weather Proof IP 65 environmental housing made of aluminum and Sun shroud. The housing, with heater and blower installed, shall provide protection for camera/lens assemblies in the ambient temperature range of - 0 deg. C to 50 deg. C.

b) The camera mount, camera housing and camera power supply should be of the same make as that of camera and suitable for the model no. offered as specified by the manufacturer.

c) Keyboard & Joystick

Keyboard shall have full function used for system control and programming for selection of various Network switches, camera/database servers, camera functions including pan, tilt and zoom lens controls and shall be ergonomically designed.

Joystick shall be provided for achieving all control functions.

d) Work Station

Operator work station & network switch station shall be in Control Room or as finalized during the detailed engineering.

13.05.00 CABLES :

13.05.01 Cables shall be of FRLS PVC sheathed cables for use in CCTV and shall conform to latest edition of Indian/International standards. Fiber optic cables are to be provided (as applicable). The remaining cables can be as per CCTV supplier's standard. For details of Fiber Optic cables, refer subsection INST CABLE. All the cables and the hardware required for powering the system are also in the scope of Contractor. All cables required for interfacing alarm contact inputs (to be provided by employer) to CCTV system are also in scope of contractor.

13.05.02 For estimation of cable quantities, erection hardware etc., the Contractor shall refer to General Layout Plant, Equipment Location Plans drawings & other relevant drawings to be finalized during detailed engineering. All the cables are to be provided by the Contractor on as required basis.

14.00.00 PUBLIC ADDRESS SYSTEM (PAS)

The quantities mentioned below are minimum required and location of the call stations shall be decided at the time of detailed engineering:

S. No.	Item Description	Quantity (nos.)		
1.	Call Stations			

TECHNICAL REQUIREMENTS

	(i)	Outdoor wall/column mounting type with amplifier	10		
	(ii)	Indoor desk top mounting type with amplifier	10		
2.	Master Control Unit (MCU)		1		
3.	Amplifier				
		Standalone amplifier	1		
4.	Loudspeakers				
	(i)	Outdoor Industrial Horn type	10		
	(ii)	Indoor wall mounted Cone type	10		
5.	Portable call stations with network connection port				
	(i)	Network connection ports	10	-	-
	(ii)	Portable call station with minimum 2 meters connecting cable	2	-	-
6.	Cables				
	(i)	All Interconnecting cables including power cables	On as required basis within the Contractor's quoted lump sum price		
7.	G.I. conduit for				
	(i)	Interconnecting cables	On as required basis within the Contractor's quoted lump sum price		
8.	Acoustic hood (nos.)		5	-	-
9.	Server		Minimum one redundant server		
10.	PC Station		one located at CR		
11.	Network Switches		On as required basis within Contractor's quoted lump sum Price.		
12.	Layer-III Switch/Router		On as required basis within Contractor's quoted lump sum Price.		
13.	Software(s) for PA system		On as required basis within Contractor's quoted lump sum Price.		
	NOTES				

TECHNICAL REQUIREMENTS

1.	Any other equipment, accessories and facilities required for the completeness of this system shall be furnished by Contractor on as required basis within the quoted price.
2.	Refer S.No.6, the cable shall be laid in existing cable trays. If cable is unarmoured, the same shall be laid in G.I. conduits.
3.	* These loudspeakers shall be connected to Standalone Amplifiers.

14.01.00 General Requirements

14.01.01 The intent of the specification is to define the functional & design requirements for the Public address system. The Contractor shall be responsible for selection, design, engineering, manufacturing, testing at manufacturer's works/ site, erection, installation and commissioning of public Address system meeting the intent and functional requirement of specifications.

14.01.02 The Bidder's scope shall also include successful demonstration of performance testing specified herein complete in all respects. All the items, including public Address system erection hardware, racks, cables, cable trays, conduits, etc. as required, for the proper installation (conforming to IS:1881, IS:1882) to make the IP based PA system complete and functional are under Contractor's scope on as required basis. All equipment, accessories and facilities required for completeness of this system shall be furnished by the Contractor within the quoted lump sum price, whether these are specifically mentioned herein or not.

14.01.03 The equipment furnished under this section shall meet the requirements of all-applicable codes and standards as specified in Part-C, Section-VI or their equivalent international codes and standards.

14.01.04 The Public Address System (PAS) offered by the Bidder shall be from reputed manufacturer who should have designed, manufactured, tested and commissioned a distributed amplifier type industrial Public Address systems as specified in thermal power plants or large industrial installation as on the date of bid opening.

14.01.05 The system shall be adequately protected from signal and power line noise and meet the Surge Withstand Capability (SWC) requirements of ANSI C37.90 A/IEEE standard 472-1989 or equivalent. Equipment shall be self-protecting against transients in the input ac supply

14.01.06 The Bidder shall guarantee satisfactory performance of the equipment under stipulated variations of voltage and frequency. The design and manufacture shall be such that equipment/components of same type and rating shall be interchangeable.

14.01.07 In addition to the facilities to be provided by the Bidder as mentioned in relevant clauses of this section the Bidder shall make his own arrangements for any other requirements that are necessary to put the system in service.

14.02.00 POWER SUPPLY ARRANGEMENT

14.02.01 The PA system along with all its system components i.e. network switches, servers, media converters, PC stations etc. shall be powered from UPS system. Contractor shall also provide local power distribution boxes on as required basis for sub-distribution of UPS supply.

14.02.02 For call stations & amplifiers, mini UPS of suitable rating are to be provided by the Contractor within his quoted lump sum price. Contractor shall also provide local power distribution boxes as required for sub-distribution of supply from mini-UPS to call stations & amplifiers. The location of mini-UPS & power distribution scheme shall be finalized during detail engineering.

TECHNICAL REQUIREMENTS

14.02.03 If the offered equipment is operating at voltage level other than what has been specified, the Contractor shall provide all required hardware, within lump sum quoted price to make the offered system compatible with specified power supply arrangement.

14.03.00 SYSTEM DESCRIPTION

DESIGN AND TECHNICAL REQUIREMENTS

14.03.01 The PA system shall be designed as standalone IP based network architecture. The system shall be based on centralized control together with distributed nodes permitting speech broadcasts and pre-recorded messages /alarm tones etc. The PA system shall be designed such that no single failure shall disrupt the availability of complete system. A redundant server catering to all zones of the plant shall be located at CER.

14.03.02 The carrier system shall be based on Voice Over IP, extended to provide IP communication across the complete PA system. The call stations and standalone amplifiers shall be individually IP addressable. Any conversion of the analog field call station to IP mode by separate attachment of the intelligent module/ unit shall not be acceptable. Each call station should be able to selectively call another call station without manual intervention of any other equipment. The design shall be such as to provide highly intelligible full duplex voice communication even in areas of high background noise (up to 80 db).

14.03.03 PA System Management Software:

Configuration of the system shall be achieved by user Friendly GUI based software for maximum flexibility, easy re-configuration, maintenance & future expansion. This software should be configured on each PC station, located at Unit CER which enables an operator to implement speed commissioning and also carry out routine diagnostic checks / fault finding functions of PA system components. It should be possible to make adjustments when the system is installed without resulting in modification to the system wiring. It shall be possible to download/ store the configuration parameters & scheme from the server without taking the system out of service. Levels of system access and privileges shall be maintained through security passwords etc. The software shall be able to work with the latest windows version. All software utilized shall be latest and upgraded version.

14.03.04 Built in Diagnostic features:

The Bidder shall provide all hardware/software in order to have a comprehensive built in diagnostic test feature covering the complete PA system components including call stations & amplifiers, standalone amplifiers along with associated loudspeakers, servers, network components i.e. network switches and interconnecting cables, power supplies etc. so that at all times, the status of the complete system can be monitored. Active fault reporting concerning all aspects of PA system shall be extended to PC Stations which shall record the system malfunction messages with time & date stamp.

14.03.05 Recording functionality for calls to and from master call station in each zone shall be provided. System shall ensure that once recorded, audio cannot be altered.

14.03.06 The system shall be able to accept potential free contacts from other systems (like fire alarm system, security system and access control system etc.) for predefined actions (like fire or security alarm announcement on call stations (configurable) etc.) For implementation of the same, 10 nos. potential free contacts for common plant area shall be provided by Employer for interfacing with PA system. The exact details shall be finalized during detail engineering.

14.04.00 Communication within a zone

TECHNICAL REQUIREMENTS

- 14.04.01 The PA system shall allow party calls i.e. between one call station to another and also Group/ conference calls i.e. simultaneous conversation amongst multiple call stations. Party calls and group/conference calls shall be in full duplex mode.
- 14.04.02 Each call station shall be able to broadcast a message to all the associated call stations or selected call stations in a zone. The priority of call mode or broadcast mode or Emergency priority settings shall be configurable for each call Station.
- 14.04.03 Portable type call stations with network compatible ports shall be used at certain location where operational personnel are not present normally. Necessary network connection, power supplies etc., shall be provided at these locations. The locations (distributed across different zones) shall be finalized during detailed engineering.
- 14.04.04 Unless requested, announcements/communication within a zone shall not be audible in other zones.

14.05.00 CALL STATION

- 14.05.01 Call Stations shall be of the following types:
- (a) Outdoor Wall/column mounting type.(Type – A)
 - (b) Indoor desk-top mounting type. (Type – B)
- 14.05.02 Each Call Station shall have LCD indicator, 10 digit dial pad & 2 special keys, Pre-amplifier & power amplifier, Indication for 'Power Supply On' and 'Network Connection Healthy' as a minimum.
- 14.05.03 The outdoor wall/column mounting type call station shall be dust-tight and weather proof, with appropriate protection against direct rain, ingress of dust and moisture conforming to IP-65 degree of protection as per IS/IEC:60947-1, outdoor wall/column mounting type. The indoor desk-top mounting type call station shall have a degree of protection of at least IP-32. All call stations and their components shall be capable of continued satisfactory operation at an ambient temperature at 55 Deg C.
- 14.05.04 The indoor desk-top mounting type call station shall be suitable for flush mounting on control desk Suitable accessories for the same shall be provided by Contractor.
- 14.05.05 Call stations transmitter/microphone shall be dynamic noise cancelling type and anti-side tone control facility shall be inbuilt.
- 14.05.06 All call stations shall have a compact, robust, rust resistant, shock resistant body made of high impact polycarbonate/ Stainless Steel or equivalent. The outdoor call station shall be inside an enclosure with transparent glass door which can be opened through number padlock only.
- 14.05.07 The wall/column mounting call stations shall be tamper-proof, using internal anchoring bolts and peculiar (e.g. triangular head, counter-sunk) screws which can be loosened only with special keys. Constructions where the entire electronic part shall be modular type and can be removed from the call station enclosure for easy maintenance.
- 14.05.08 The call stations in the noisy areas like Engine hall, etc. shall be housed in Acoustic hoods. An industrial type free standing, floor mounting hood shall be used for providing the above requirement. The design noise level within the hood shall be limited to a maximum of 60dB SIL.
- 14.05.09 The indoor desk mounting type call stations shall preferably be PoE powered and the same shall be IEEE 802.a.f compliant.

14.06.00 AMPLIFIERS

TECHNICAL REQUIREMENTS

14.06.01 Amplifiers shall be solid state, class-D, push-pull type, in built with the call station fully conforming to IS: 10426 or equivalent international standard.

14.06.02 Amplifier shall have 0-100% volume control facility for coarse and fine setting, Input sensitivity control, Receiver volume control, Bass cut filter and Anti-side tone control feature

14.06.03 Standalone Amplifier

Amplifiers of suitable rating as mentioned in Part-A of specifications shall be provided for general announcement. Multiple loudspeakers spread across a zone shall be used along with a standalone amplifier. This amplifier shall be IP based and health monitoring of the associated loudspeakers shall be provided.

14.07.00 LOUDSPEAKERS

14.07.01 Indoor loudspeaker shall be cone type housed in sturdy metal cabinet suitable for wall/column mounting. The mounting bracket shall be treated with acoustic under-coats to prevent resonance. They shall have IP-52 degree of protection as per IS/ IEC:60947-1.

14.07.02 Outdoor loudspeaker shall be industrial horn type and of pressure die cast aluminum or equivalent industrial grade material construction. The mounting bracket shall be with adjustable base suitable for vertical and horizontal orientation. They shall have IP-65 degree of protection as per IS/ IEC:60947-1.

14.08.00 SERVER

14.08.01 The server shall be based on state of art VOIP technology. The server should support protocols including SIP or equivalent, TCP, IPV4/ IPV6, Codec G.722, SNMP, RTP, NTP etc. Suitable built in IP security such as firewall, SSH, HTTPS etc. shall be provided in server. The server should be able to support the required number of call stations with future provision as defined in Part-A of the specifications. The required no. of all hardware/software licenses to meet the Employer specifications shall be supplied by the Contractor.

14.08.02 The server shall be capable of self-recovery in case of any fault/ network break down. It shall be rack mounted type.

14.08.03 The server shall be able to support minimum 4 channels for GSM communication with PA system. Suitable interface for the same shall be provided by Contractor.

14.08.04 All programming tools & software that are required to program/ reprogram the system shall also be provided along with the server.

14.09.00 MASTER CONTROL UNIT

The Master Control Unit shall facilitate interzone communication amongst different zones. It shall have minimum 40 direct access keys with LED indication, which shall be configured as per requirement, a goose neck type Microphone and a hand receiver unit attached to it. Emergency announcement facility like fire alarms etc., shall be done from master control unit automatically.

14.10.00 NETWORK SWITCH

All the network switches shall be of high quality and shall be sized to meet the functional requirements as specified. The location of network switches shall be decided during detail engineering and shall be subject to approval of Employer.

14.11.00 PC STATION

TECHNICAL REQUIREMENTS

PC station shall be provided for overall viewing and monitoring of PA system functionality in plant area. It shall be provided with PA system management software as mentioned elsewhere. For hardware specification please refer specification of Operator work stations given in sub-section-PLC.

14.12.00 CABLES AND JUNCTION BOXES

- 14.12.01 The bidder shall supply the all required cables for PA system on as required basis. Colour of the outer sheath shall be YELLOW. All cables of PA system shall be armoured, if unarmoured, the same shall necessarily be laid in GI conduits.
- 14.12.02 Cables shall be of FRLS PVC sheathed cables for use in PA system and shall conform to latest edition of Indian/International standards.
- 14.12.03 Twisted multipair, multistrand with at least one spare pair, minimum 0.5 mm² cross section, annealed copper (shielded and armoured) shall be provided for Loud speakers.

14.13.00 TECHNICAL PARTICULARS

Public Address Systems shall conform to the following technical parameters.

Items	Technical Particulars
(i) Amplifiers	
(a) Band width (± 3 db)	100-16000 Hz
(b) THD	< 0.5% at 1 KHz at rated output
(c) Signal to Noise Ratio	Min. 80dB
(ii) Microphones	
(a) Band width (± 3 db)	Codec G.722, 200-7000Hz
(b) Type	Omnidirectional & Dynamic noise cancelling type
(iii) Loudspeakers	
(a) Outdoor	wall/column mounted Horn Type
(i) Capacity	105 dB for broadcast, 95dB for call mode, 15 W (RMS)
(b) Indoor	wall/column mounted Cone Type
(i) Capacity	85dB , 4W (RMS)

15.00.00 WALKIE TALKIE

5 Nos. of industrial grade Walkie Talkie sets shall be provided by the Contractor along with all required licenses from government authorities.

2.00.00 16.00.00 C&I LABORATORY

TECHNICAL REQUIREMENTS

Contractor has to set up a laboratory as per process requirement with minimum quantity and type of instruments indicated as below:

Sl. No.	Description of Equipment	Total Quantity Common for plant
1.0	Electronic Test Bench	1
2.0	Pneumatic Test Bench	1
3.0	Dead Weight Tester	1
4.0	Vacuum Tester	1
5.0	Vacuum Pump	1
6.0	Manometers	
	(i) Test Manometer	2
	(ii) U-Tube Manometer	2
7.0	Standard quality pressure Gauges of following ranges: (-) 1-0 (bar), 0-1 kg/sq.cm, 0-1.6 kg/sq.cm, 0-2.5 kg/sq.cm, 0-4 kg/sq.cm, 0-6 kg/sq.cm, 0-10 kg/sq.cm, 0-25 kg/sq.cm, 0-40 kg/sq.cm, 0-60 kg/sq.cm, 0-100 kg/sq.cm, 0-250 kg/sq.cm, 0-400 kg/sq.cm, 0-600 kg/cm ²	2 no of each range
8.0	Air Set	4
9.0	Portable Electro-pneumatic Calibrator (Accuracy 0.05%)	
	Range 0-2 Kg/sq.cm, Range 0-20 Kg/sq.cm	2 sets of each range
10.0	Laboratory Grade Temperature Dry Block Calibrator	
	High Range	1
	Low Range	1
11.0	Thermocouple Test Furnace	1
12.0	Barometer	1
13.0	Digital Thermometer	4
14.0	Stop Watches	3
15.0	Precision Instrument Radial Drilling Machine with all Standard Tools	1
16.0	Standard toolbox for instrument maintenance work	3 sets
17.0	Digital Thermometer/Hygrometer	2
18.0	Soldering/de-soldering station with all accessories	2

TECHNICAL REQUIREMENTS

19.0	Portable Digital Tachometer	2	
20.0	Multimeter		
	(i) Digital Multimeter 5½ digits	2	
	(ii) Digital Multimeter 6½ digits	2	
	(iii) Portable Digital Multimeter 4½ digits	3	
	(iv) Portable Digital Multimeter 3½ digits	3	
21.0	Portable Current/mV calibrator	2	
22.0	Resistance Thermometer Bridge	2	
23.0	Decade Resistance Box	2	
24.0	Decade Capacitance Box	2	
25.0	Decade Inductance Box	2	
26.0	Variac (Single Phase)	2	
27.0	Rheostat/Potentiometers of following ratings		
	Amp.	Resistance in ohms	
	12	3	2
	15	1.8	2
	2	47	2
	2	100	2
	1	470	2
28.0	Test Resistance Temperature Detector and Test Thermocouple	2 each	
29.0	Portable thermocouple/RTD Calibrator/simulator	2	
30.0	Portable Multi-function counters	1	
31.0	Digital Storage Oscilloscope	2	
32.0	Portable Power Pack	2	
33.0	Portable Vibration Meter	2	
34.0	Portable Vibration Analyzer	1	
35.0	RCL meter	1	
36.0	pH Simulator	1	
37.0	Logic Probe	2	
38.0	Function Generator	2	
39.0	Portable Infrared Thermometer	1	
40.0	Clip-on AC Power Meter	1	
41.0	Portable Flue Gas Analyzer	2	

TECHNICAL REQUIREMENTS

42.0	Portable High Speed Trend Recorder	1
43.0	LAN/Coaxial cable meter/tester	1
44.0	Digital Insulation Tester	2
45.0	Bench Magnifier	1
46.0	Industrial vacuum cleaner	1
47.0	Drawing Scanner (A3 Size)	1
48.0	PCs	2
49.0	Portable Ultrasonic flow meter	1
50.0	Ground resistance tester	1
51.0	Fiber Optic testing tool set	2

PART-B
VOLUME – IV
CIVIL WORKS

CIVIL WORKS

1.00.00 **Sea Water Intake & Brine disposal system**

The scope of work covers design, supply & construction of sea water drawl system and Brine disposal into sea based on study carried out from reputed institute including all associated facilities etc. complete as per system requirements.

Bidder shall conduct studies through reputed institutes like (i) Department of Ocean Engineering, IIT Madras (ii) National Institute of Oceanography, Goa (iii) National Institute of Ocean Technology, Chennai to finalize the design and details of the sea water intake system and diffuser arrangement.

The Sea water Intake system and approach jetty shall be designed to withstand dynamic forces of waves and tides. Bathymetric survey and geotechnical investigation required for design & construction of Sea Water Intake & Brine disposal system shall be carried out by the Bidder.

1.01.0 **General requirements**

This specification covers design, preparation of construction and fabrication drawings, supply of labour, materials and construction of all civil, structural and architectural works.

The work to be performed under this specification consists of design, engineering and providing all labour, materials, consumables, equipment, temporary facilities, constructional plant & equipment, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion of the work, all in strict accordance with the specifications including revisions and amendments thereto as may be required during the execution of work.

All materials including cement, reinforcement steel and structural steel etc. shall be provided by the Bidder.

The work shall be carried out according to the design/ drawings to be developed by the Bidder and approved by the Employer. For all facilities, systems, structures, etc., necessary layout and details are to be developed by the Bidder keeping in view the statutory and functional requirements and providing enough space and access for use, operation and maintenance. The Bidder's work shall cover complete requirements as per IS codes, fire safety norms, requirements of various statutory bodies, International Standards, best prevailing practices and to the complete satisfaction of the Employer.

All the quality standards, tolerances, welding standards and other technical requirements shall be strictly adhered to.

The Bidder shall visit site before submission of his bid and shall fully apprise himself of the prevailing conditions at the proposed site, the climatic conditions (in particular the monsoon pattern), soil conditions, approach/access to site, availability of construction materials, labour, plant & equipment, working environment & other conditions and site specific information as required by him and shall include for all such conditions and contingent measures in his bid, including those which may not have been specifically brought out in the specifications.

In case of any conflict between stipulations in various portions of the specification, most stringent stipulation would be applicable for implementation by the Bidder without any extra cost to the Employer.

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2.00.00 SUBMISSIONS

2.01.00 Commencement of construction shall be done after approval of the relevant design documents and drawings. All drawings shall be of standard sizes (Metric System) and shall be made on AutoCAD. All documents shall be made using MS office.

3.00.00 DESIGN CRITERIA

3.01.00 General

3.01.01 Structures shall be analysed and designed for the most critical combinations of dead loads, imposed loads, equipment loads, crane loads, piping loads (static, friction and dynamic), wind loads, seismic loads, dust loads and temperature loads. In addition, Erection loads, loads and forces developed due to differential settlement shall also be considered.

3.02.00 Loading

3.02.01 Dead loads

Dead loads shall include the weight of structure complete with finishes, fixtures and partitions, false-ceiling and shall be taken as per IS: 875.

3.02.02 Imposed loads

- a) Imposed loads in different areas shall include live loads, erection, operation and maintenance loads. Equipment loads (which constitute all loads of equipment to be supported on the building frame and as supplied by the equipment supplier), pipe loads (static, friction and dynamic), cable/ducts loads are not included in the imposed loads furnished below and shall be considered in addition to imposed loads.
- b) For consideration of imposed loads on structures, IS: 875 "Code of practice for design loads (other than earthquake) for buildings and structures" shall be followed.

3.02.03 Equipment, piping and associated loads

Loads of all equipments shall be considered over and above the imposed loads. Equipment loads shall be considered as given by equipment supplier. Equipment loads which are of permanent nature shall be treated as dead loads.

3.02.04 Crane load

For crane loads, an impact factor of 25% and lateral crane surge of 10% (of lifted weight + trolley weight) shall be considered in the analysis of frame according to the provisions of IS: 875. The longitudinal crane surge shall be 5% of the static wheel load. Longitudinal surge and lateral surge shall not be considered to act simultaneously.

3.02.05 Wind load

Wind forces shall be considered as per the criteria specified in **Annexure-I**.

3.02.06 Seismic load

Seismic loads shall be taken as per the criteria specified in **Annexure-II**

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3.02.07

Temperature load

For temperature loading, the total temperature variation shall be considered as 2/3 of the average maximum annual variation in temperature. The average maximum annual variation in temperature for this purpose shall be taken as the difference between the mean of the daily minimum ambient temperature during the coldest month of the year and mean of daily maximum ambient temperature during the hottest month of the year. The structure shall be designed to withstand stresses due to 50% of the total temperature variation.

Suitable expansion joints shall be provided in the longitudinal direction wherever necessary with provision of twin columns. The maximum distance of the expansion joint shall be as per the provisions of IS 800 and IS 456 for steel and concrete structures respectively. In Limit state design, the partial safety factor for temperature load in load combinations shall be taken same as specified for dead load (DL) in Table 4 of IS 800: 2007 for steel structures and in Table 18 of IS 456 for concrete structures.

4.00.00

Geotechnical Investigation

The Contractor shall carry out detailed geotechnical investigation in the areas under his scope for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Contractor shall obtain the approval for the field testing scheme proposed by him from the Owner before undertaking the geotechnical investigation work.

5.00.00

CORROSION PROTECTION MEASURES

Due to aggressive marine environment (atmospheric and sub-soil) all structural steel and RCC members/structures shall have to be provided with special corrosion protection treatment.

5.01.00

General

- (a) Painting system shall meet the requirements of Corrosivity category C5 (durability very High) as per ISO 12944.
- (b) All Painting shall be done as per technical specification.
- (c) All steel structures shall be designed by following basic design criteria in ISO 12944 Part-3. However, where it is not feasible to follow the design criteria given in ISO 12944 Part 3 where the steel surface are inaccessible for application of protective coating, corrosion allowance of 1.5 mm shall be kept in thickness (over the design thickness) of structural steel members.

5.00.02

Painting of Steel Surfaces embedded in Concrete.

- (a) For the portion of Steel surfaces embedded in Concrete, the surface shall be prepared by Manual Cleaning and provided with Primer Coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron Dry Film Thickness (DFT).

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- (b) All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, sleeves, etc. shall be coated with temporary rust preventive fluid and during execution of civil works, the dried film of coating shall be removed using organic solvents.

5.00.03 **Painting of Steel Surfaces (other than those embedded in Concrete)**

- (a) All steel surfaces shall be provided with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% \pm 2%) of minimum 70 micron DFT to be applied over blast cleaned surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00.
- (b) Primer coat shall be followed with the application of Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% \pm 2%) of minimum 180 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique.
- (c) Intermediate coat shall be followed with the application of finish coat of two-pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% \pm 2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 Δ E) and minimum 70 micron DFT. This coat shall be applied shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the Employer.

Notes:

1. For Primer, high quality surface preparation is necessary and good amount of moisture is required for proper curing. Below 70 % relative humidity, curing time may go up to 7 days or more. In such a case additional water sprinkling may be ensured for completion of curing. Additionally Inorganic zinc silicate cannot be recoated; even with itself. Typically, it should be used when coating bare steel surface for first time.
2. The most frequent problem associated when top coating Primer is bubbling/pin holing especially with non-weathered zinc silicate coatings. To a great extent, this bubbling of finish paint can be eliminated by applying a mist coat of intermediate/topcoat as the first pass of the product, allow the bubbles to subside and then apply a full coat, as required.
3. In case top coating of zinc silicate with epoxy/polyurethane coatings, is expected to be delayed, it is advisable to use a suitable tie coat to avoid formation of white rust. However, if white rust forms then clean the surface with high pressure water, dry and apply the subsequent coats as required.
4. Touch up paintings on damaged areas: Surface preparation by manual tools, wire brush/emery paper etc. Minimum 6 inches peripheral area, adjoining to damaged area to be covered. If metal surface is exposed, it is to be painted with Zinc rich epoxy (70 micron) or suitable primer with existing paint scheme. If primer is intact, intermediate & top coat to be done with specified DFT in scheme.

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- (II) Painting system for steel Doors/Windows, steel structure of single / double storey buildings and outdoor lighter steel structures like pipe and cable trestles etc. shall be as given below :
- a) Painting system shall be of approved colour and shade consisting of high Build Surface Tolerant aluminium Epoxy Mastic primer of minimum thickness 35 micron DFT, intermediate coat and final finish coat (as given below) including manual cleaning with mechanical tools and wire brushing of surfaces (St. 2 or St. 3 as per Swedish Standards SIS 05 5900) of all types, shapes and sizes, at all levels, to achieve an even shade.
- a. For Steel Doors/Windows, Intermediate coat & final finish coat shall consist of Acrylic High Build Polyurethane Enamel paint cured with Aliphatic Iso-Cyanite with minimum thickness of 35 micron DFT for each coat including touch up painting for the damaged surfaces, applied over High Build Surface Tolerant Aluminium Epoxy Mastic Primer (of minimum 35 micron DFT). Total thickness of primer, intermediate coat & finish coat shall be 105 micron DFT.
- b. For Fire Proof doors, Intermediate coat & final finish coat shall consist of Fire Retardant Paint of minimum thickness of 35 micron DFT for each coat, including final touch up painting for the damaged surfaces, applied over High Build Surface Tolerant Aluminium Epoxy Mastic Primer (of thickness 35 micron DFT). Total thickness of primer, intermediate coat & finish coat shall be 105 micron DFT.
- c. For outdoor lighter structures like pipe & cable trestle etc, intermediate coat & finish coat shall consist of High Build Poly Urethane Aluminium Paint, including final touch up painting for the damaged surfaces applied over High Build Surface Tolerant Aluminium Epoxy Mastic Primer (of thickness 35 micron DFT). Total thickness of primer, intermediate coat & finish coat shall be 75 micron DFT.

5.04.00 Dry film thickness of each coat shall be checked and measured as per the procedure specified in paint application standard no. 2 by SSPC: The Society for Protective Coating. The thickness as measured shall not be less than the minimum thickness specified for the coat of paint under relevant clauses of technical specification.

5.05.00 **Gratings**

All gratings shall be blast cleaned to Sa 2 ½ finish or cleaned by acid pickling as per ISO 8501-1 and shall be painted in accordance with clause 5.00.03.

5.06.00 **Hand Railings and Ladders**

All handrails and ladders shall be painted in accordance with clause 5.00.03.

5.07.00 **Sea Worthiness**

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All Steel Sections and fabricated Structures, which are required to be transported on sea, shall be provided with anti corrosive Paint before shipment to take care of sea worthiness.

5.08.00 All other steel members like doors, rolling shutters, pipe supports etc. shall be painted as per the details as above.

6.00.00 Concrete

6.00.01 General

- a) Concrete work shall be carried out as per IS:456. Mix design concrete shall be used for all areas other than lean concrete work and plain cement concrete where nominal/volume mix can be permitted. Design mix shall be carried out as per IS:10262. Specific approval of the Engineer shall be obtained regarding degree of quality control to be adopted for design mix.
- b) The minimum grade of concrete for all RCC structures associated with Sea Water Intake System and diffuser/outfall arrangement shall be as per IS:456 and IS:3370(Part II). Grade of concrete for piling shall be minimum M35. Durability of concrete shall conform to very severe exposure conditions as per Table-3 of IS 456 except noted specifically otherwise.
- d) Unless otherwise specified, 20mm and down aggregates shall be used for all structural concrete works. However, 40mm and down aggregates may also be used under special conditions for mass concreting in foundation.

6.00.02 Cement

Cement shall be Ordinary Portland Cement with C3A content from 5 to 8 percent / Portland slag cement conforming to IS 455 having more than 50% slag.

6.00.03 Aggregates

a) Coarse aggregate

Coarse aggregate for concrete shall be crushed stones chemically inert, hard, strong, durable against weathering of limited porosity and free from deleterious materials. It shall be properly graded. It shall meet the requirements of IS: 383.

b) Fine aggregate

Sand shall be hard, durable, clean and free from adherent coatings of organic matter and clay balls or pellets. Sand, when used as fine aggregate in concrete shall conform to IS: 383. For plaster, it shall conform to IS : 1542 and for masonry work to IS : 2116.

6.00.04 Reinforcement Steel

Reinforcement steel shall be of corrosion resistant grade high strength deformed TMT steel bars of grade Fe-415/ Fe-500/ Fe500D/ Fe550D and shall conform to IS 1786 and IS 13920. However, minimum elongation shall be 14.5%.

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Mild steel & medium tensile steel bars and hard drawn steel wire shall conform to grade-1 of IS : 432 (Part-1) or grade A of IS: 2062. Welded wire fabric shall conform to IS:1566.

6.00.05 **Structural Steel**

Structural steel (including embedded steel) shall be straight, sound, free from twists, cracks, flaw, laminations and all other defects. Structural steel shall comprise of mild steel, medium strength steel and high tensile steel as specified below.

Mild Steel

Rolled sections shall be of grade designation E250, Quality A/BR, Semi-killed/ killed conforming to IS 2062. All steel plates shall be of Grade designation E250, Quality BR (fully killed), conforming to IS 2062 and shall be tested for impact resistance at room temperature. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.

Pipes shall conform to IS:1161. Hollow(square and rectangular) Steel Sections shall be Hot Formed conforming to IS:4923 and shall be of Minimum grade Yst 240.

Chequered Plate shall conform to IS:3502 and shall be Minimum 6mm thick excluding projection. Steel for chequered Plates shall conform to Grade 'A' of IS:2062.

Medium and High Tensile Steel

Rolled Sections and plates shall be of grade designation E350 or higher, Quality B0 (Fully killed), conforming to IS: 2062. Plates beyond 12mm thickness and up to 40mm thickness shall be normalized rolled. Plates beyond 40mm thickness shall be vacuum degassed & furnace normalised and shall also be 100% ultrasonically tested as per ASTM –A578 level B-S2.

All other Materials shall be as per applicable Standards and Codes.

6.00.06 **Hollow Concrete Blocks/Bricks**

6.00.06.01 Hollow concrete blocks shall be of minimum A (7.0) grade conforming to IS 2185 Part-1. Thickness of hollow concrete blocks shall be 230mm.

6.00.06.02 Fly ash lime bricks conforming to IS:12894 and fly ash clay bricks conforming to IS:13757 shall be used. The crushing strength of bricks shall be minimum 75 kg./sq cm. Minimum percentage of fly ash shall be 25%.

6.00.07 **Water**

Water used for cement concrete, mortar, plaster, grout, curing, washing of coarse aggregate, soaking of bricks, etc. shall be clean and free from oil, acids, alkalis, organic matters or other harmful substances in such amounts that may impair the strength or durability of the structure. Potable water shall generally be considered satisfactory for all masonry and concrete works, including curing. When water from the proposed source is used for making the concrete, the maximum permissible impurities,

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development of strength and initial setting time of concrete shall meet the requirements of IS:456.

7.00.00 STATUTORY REQUIREMENTS

7.01.00 Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules at Tariff Advisory Committee. Water Act for pollution control, Explosives Act, etc.

7.02.00 Provisions of safety, health and welfare according to Factories Act shall be complied with.

7.03.00 Statutory clearances and norms of State Pollution Control Board shall be followed.

8.00.00 LIST OF CODES AND STANDARDS

All applicable standards, references, specifications, codes of practice, etc., shall be the latest edition including all applicable official amendments and revisions.

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ANNEXURE-I

A & N GAS POWER PROJECT

CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for wind forces in accordance with IS: 875 (Part-3) and as specified in this document. See Annexure - IB for site specific information.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than "5" and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875 (Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

- | | | |
|-----------------------------------|---|--|
| a) Welded steel structures | : | 1.0% |
| b) Bolted steel structures | : | 2.0% |
| c) Reinforced concrete structures | : | 1.6% |
| d) Steel-stacks | : | As per IS: 6533 & CICIND Model Code, whichever is more critical. |

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ANNEXURE - IB

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

- | | | |
|----|--|-------------------|
| a. | The basic wind speed " V_b " at ten metres above the mean ground level | 44 metres/ second |
| b. | The risk coefficient "K1" | 1.07 |
| c. | The risk coefficient "K4" | 1.15 |
| d. | Category of terrain | Category-1 |

Note: Notwithstanding the values of the above mentioned parameters, the design wind pressure so computed at any point shall not be taken less than 1500 N/M² for all classes of structures, i.e. A, B & C, as defined in IS: 875 (Part-3).

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ANNEXURE - II

ANDAMAN & NICOBAR GAS POWER PROJECT

CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures and equipment shall be designed for seismic forces using the other provisions in accordance with IS:1893 (Part 1):2002 and IS:1893 (Part 4):2005. Pending finalisation of Parts 2, 3 and 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for structures other than the buildings and industrial structures including stack-like structures.

Site falls in Seismic zone V.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

- | | | | |
|----|--------------------------------|---|----|
| a) | Steel structures | : | 2% |
| b) | Reinforced Concrete structures | : | 5% |
| c) | Reinforced Concrete Stacks | : | 3% |
| d) | Steel stacks | : | 2% |

PART-B
VOLUME – V
MASTER DRAWING LIST

TECHNICAL REQUIREMENTS

1.00.00 Master Drawing List (MDL)

This part describes tentative Master Drawing List (MDL). The submission schedules of drawings shall be finalized based on project schedule.

2.00.00 Engineering Drawing Review Methodology:

To reduce engineering cycle time and no. of drawings in approval category, following Engineering Drawing Review Methodology shall be adopted:

- a. **Auto-archive of drawings:** Contractor will certify that these drawings are complying with technical specification requirements.
Endorsement of drawings: NTPC will select base for endorsement of drawings and submit list of drawings to Contractor for endorsement. The list shall be finalized after discussion with Contractor. After agreement, the approved drawings shall be taken out from DREAMS for endorsement and stamped applicable for Andaman Gas Power Project..
- b. Dedicated Contractor and NTPC engineering team shall be identified.
- c. Wherever input data is not available for preparation of drawing, latest similar projects input data (with not to exceed data) will be used for further engineering.
- d. **Cluster of drawings:** The drawings will be identified in different clusters for submission/approval purpose depending upon the requirement at site. The submission schedule shall be decided based on proposed L2 network. The L2 network will be agreed upon with Contractor before NOA.
- e. After Rev 0 comments, the drawing will be locked in the system. Contractor will review the Rev 0 comments within 7 days & furnish the Comment Reply Sheet (CRS) to NTPC as an agenda point for TCM. TCM shall be conducted with Contractor on non-agreed comments of CRS.
- f. System will not allow Contractor to submit approval category drawings before the scheduled submission date. However, documents may be unlocked on case-to-case basis.

TECHNICAL REQUIREMENTS

- g. Based on resolution of all comments and agreements, the document will be approved in TCM itself. The contractor will revise the document based on the resolutions and certify that all the resolutions has been taken care of.
- h. Based on this certification, the document will be opened and submitted by contractor in the system for approval as Rev 01 within 10 days of TCM.

3.00.00 **GENERAL REQUIREMENTS**

3.00.01 This part describes the technical information and data to be furnished by the Bidder for the equipment and services described in Section-VI.

3.00.02 The Bidder shall ensure that all information, data, performance curves, technical literature (catalogues) and drawings furnished fully describe all equipment/systems covered and fully meet the requirements of the technical specifications.

3.00.03 The Employer reserves the right to ask for further details regarding technical features, application particulars, performance, past experience for similar applications or any other information as may be required to fully satisfy himself regarding suitability, quality, reliability and full compliance with this specification for all equipment and systems offered by the Bidder.

3.00.04 Bidder shall be required to furnish all additional data about the equipment/system being supplied, even if such details are not specified in this section.

4.00.00 **Data Requirements**

4.01.00 Data to be necessarily included in **General Arrangement Drawing** of respective equipments:

1. Design and Test code
2. Make/Manufacturer
3. Model/Type
4. Equipment Rating/ Basic design data
5. Equipment quantity
6. Thermal/Mechanical/operational/Performance data as applicable
7. Construction data
8. Part Lists
9. MOC
10. Bill of materials (BOM)
11. Different dimensions
12. Vibration and Sound data

TECHNICAL REQUIREMENTS

13. Nozzle schedule/Connection list (if applicable)
14. Allowable Force and Moments of Nozzle (if applicable)
15. Different Loads to be considered for foundation design (if applicable)
16. Surface preparation and painting schedule
17. Major elevations/levels
18. Weight of equipment (Empty/operating/full weight), Max weight for maintenance/Erection, Shipping dimensions (size, weight)
19. Special/Standard notes (if any)

4.02.00 Cross-sectional Drawing Data requirement:

1. Bill of Materials
2. Different dimensions
3. Different Clearances
4. Model Number (if applicable)
5. Design and testing code
6. Special/Standard notes (if any)

4.03.00 P&ID / Scheme/Write-up data requirement:

1. Design pressure/temperature/flow/Velocity
2. Operating pressure/temperature/flow/Velocity
3. Line size/thickness
4. KKS TAG numbers
5. MOC
6. Scope & Terminal Points
7. Special/Standard notes (if any)
8. In write-up, description of each equipment shall accompany set point, rated parameters/size (as per applicability), permissive, interlock, protection, any curves for variable set point, calculation for variable set point etc.

4.04.00 Sizing calculation

1. Design/Sizing criteria/Design Parameters
2. Codes/Standards
3. Thermal/Hydraulic/ Mechanical calculation
4. Special/Standard notes (if any)
5. Sizing related Heat Balance diagrams

TECHNICAL REQUIREMENTS

4.05.00 Datasheet

All the required information shall be compiled from GAD, Cross-sectional drawing, Scheme, Write-up, Sizing document etc and any specific data for a particular equipment which is necessarily to be furnished shall be incorporated in the datasheet of the equipment.

Tentative Master Drawing List

S.NO.	DRG_TITLE	SUB-SYSTEM	CAT
1	General Layout of the plant	Engine	A
2	Engine hall General arangement INCLUDING FOUNDATION PLAN, LOADING & FIXING DETAILS of equipments	Engine	A
3	SIZING CALC FOR ROPES, WHEELS, DRUM,BUFFERS, BRAKES & MOTORS- EOT CRANE	Engine	A
4	GA OF OIL PURIFIER (PLOT PLAN)	Engine	A
5	P & ID OF TURBINE OIL PURIFIER	Engine	A
6	DATA SHEET OF TURBINE OIL PURIFIER	Engine	A
7	Type test procedure of oil purifier	Engine	A
8	Type test report of oil purifier	Engine	A
9	GA of Clean Oil tank	Engine	A
10	GA of Dirty oil tank	Engine	A
11	P&ID FOR CENTRAL LUBE OIL STORAGE SYSTEM	Engine	A
12	Genset data sheet	Engine	A
13	Engine lube oil coolers data sheet	Engine	A
14	Engine cooling water flow P&ID	Engine	A
15	Engine Lube oil P&ID	Engine	A
16	GA of Radiator	Engine	A
17	DATA SHEET & GA OF LUBE OIL TRANSFER PUMPS	Engine	A
18	DATA SHEET & GA OF LUBE OIL Unloading PUMPS	Engine	A
19	DATA SHEET & GA OF LUBE OIL Engine evacuation PUMPS	Engine	A
20	Engine foundation design drawing	Engine	A
21	OIL COOLER - THERMAL CLACULATION	Engine	A
22	GA & Datasheet- Oil Cooler	Engine	A
23	GA & Datasheet of Oil filter/strainer	Engine	A
24	Engine operating philosophy	Engine	A
25	GA of EOT crane	Engine	A
26	CRAB ASSEMBLY WITH CT WHEEL ASSEMBLY- Engine HALL CRANE	Engine	A
27	HOOK, NUT AND HOOK BLOCK ASSEMBLY OF Main hoist OF Engine HALL EOT CRANE	Engine	A
28	GANTRY RAIL FIXING ARRANGEMENT- EOT CRANE	Engine	A

29	CRANE CLEARANCE DIAGRAM FOR BFP EOT CRANE	Engine	A
30	Engine fuel filtration system scheme and writeup	Engine	A
31	P&ID of air intake system & gas Exhaust system	Engine	A
32	P&ID of Starting air system	Engine	A
33	Master Layout plan of engine hall	Engine	A
34	Fuel gas system - P&ID	Engine	A
35	GA and datasheet of 15 Ton hydraulic crane	Engine	A
36	Start up curve	Engine	A
37	Correction Curve	Engine	A
38	Composite piping layout of Cooling water system	Engine	A
39	Composite piping layout of Lube oil system	Engine	A
40	Composite piping layout of start up air system	Engine	A
41	Sizing of Lube oil coolers	Engine	A
42	Sizing of Radiators	Engine	A
43	Plant Operation philosophy	Engine	A
44	O&M Manual - Engine		
45	PG Test Procedure - Engine		
46	PLC Documentation - Detailed Configuration/ Architecture, BOM, Panel Drawings, data sheets.	C&I	A
47	GA/IA, Schematic and wiring diagram of PLC Based Control System along with Control desk	C&I	A
48	Data Sheet and sizing calculation for Battery for PLC system	C&I	A
49	G.A. & Schematic Drawing of UPS for PLC & Remote I/O Panel	C&I	A
50	FAT (Factory Acceptance Test) Procedure of PLC System	C&I	A
51	I/O List of PLC	C&I	A
52	I/O ASSIGNMENT of PLC system	C&I	A
53	Control Logic Diagram of PLC & Remote I/O Panel along with Graphics and HMI mimics	C&I	A
54	Type Test Report for PLC System	C&I	A
55	Control writeup for PLC based control system	C&I	A
56	Datasheet and BOM for Master Slave Clock System	C&I	A
57	GA DRAWING/DATASHEET/BOM & TYPE TEST REPORT OF PA SYSTEM and DEVICES and ACCESSORIES	C&I	A
58	System configuration , GA/IA, BOM and DATA SHEET FOR CCTV	C&I	A

59	Cable List and cable schedule	C&I	A
60	DATA SHEET FOR HMIPIS system like Servers, Workstations, Printer, Switchces, mini UPS etc.	C&I	A
61	DATASHEET FOR INSTRUMENTATION CABLES	C&I	A
62	DATASHEET FOR POWER and SUPPLY CABLES	C&I	A
63	DATASHEET FOR CONTROL CABLES	C&I	A
64	DATA SHEET FOR FIBRE OPTIC CABLE	C&I	A
65	DATA SHEET / BOM / GA / SCHEMATIC / SAMPLING DRG & TYPE TEST REPORT FOR CEMS Analysers	C&I	A
66	DATA SHEET/ BOM / GA / SCHEMATIC / SAMPLING DRG FOR O2 ANALYZER LT	C&I	A
67	DATASHEET AND BOM FOR FURNITURE-CHAIR/PRINTER DESK/COMPUTER TABLE/CONFERENCE TABLE/KEYPAD/LOCKER etc.	C&I	A
68	DATASHEET FOR PRESSURE /DP TRANSMITTER	C&I	A
69	DATASHEET/DRAWING FOR GAS FLOW METERING SYSTEM	C&I	A
70	DATASHEET FOR JUNCTION BOXES	C&I	A
71	DATASHEET/BOM for Impulse Pipe	C&I	A
72	DATASHEET/BOM FOR FITTINGS	C&I	A
73	DATA SHEET/BOM FOR ANALYSERS OF AAQMS	C&I	A
74	GA/LAYOUT/WIRING DRAWING FOR AAQMS	C&I	A
75	Factory Acceptance Test (FAT) report	C&I	A
76	GA. Datasheet, Terminal Box arrangement and Curves of LT motors (for each type and rating)	Electrical	A
77	GA AND LIST OF FITTINGS,R&D plate, HV/LV termination details, bushings GA of oil filled trf- for each rating of oil filled transformer	Electrical	A
78	GA & SLD FOR 33 kV SWITCHGEAR	Electrical	A
79	GA & SLD FOR LT SWITCHGEAR (each type and rating)	Electrical	A
80	Electrical Equipment drawings & Datasheet of HVAC System	Electrical	A
81	Electrical Equipment drawings & datasheet of Air compressor	Electrical	A
82	GA. Datasheet & Wiring diagram of Electric Actuator for Dampers	Electrical	A
83	DG SET CONTROL PANEL- GA & SCHEME	Electrical	A
84	Electrical cum Control Building Equipment Layout with transformer layout	Electrical	A
85	Detail Cable Routing Plan for complete plant	Electrical	A
86	Lightning Protection Layout for complete plant	Electrical	A
87	Cable tray layout - Electrical cum Control Building with transformer yard	Electrical	A

88	service swgr- Control Room - Equipment Layout	Electrical	A
89	Earthing & lightning protection layout- service swgr Room	Electrical	A
90	Cable tray layout-of complete plant	Electrical	A
91	Overall Below grid Earthing Layout for complete plant	Electrical	A
92	Electrical Key Single line diagram	Electrical	A
93	Control Scheme for each type of LT Swgr module	Electrical	A
94	Foundation & Loading gauge, Roller& GA & SCHEMATIC DIAGRAM FOR M. BOX oil filled trf-for each rating of oil filled transformer	Electrical	A
95	SCHEMATIC DIAGRAM 33 kV HV SWGR	Electrical	A
96	DETAILS OF LIGHTNING PROTECTION & EARTHING- CHIMNEY	Electrical	A
97	DATASHEET, GA & SLD FOR 415V SWITCHGEAR	Electrical	A
98	HT & LT TRANSFORMER SIZING CALCULATION	Electrical	A
99	110V/220V DC Battery & battery Charger Sizing Calculation	Electrical	A
100	DG Set Sizing Calculation	Electrical	A
101	Design Guildelines for Cabling including fixing arrangement of flexible cable tray support system	Electrical	A
102	DESIGN GUIDELINES FOR EARTHING & LIGHTNING PROTECTION	Electrical	A
103	Design Guidelines for Lighting System	Electrical	A
104	TYPE TEST REPORT -LT SWITCHGEAR	Electrical	A
105	Type test report for LT motors (each type and rating)	Electrical	A
106	Type test Procedure for LT motors (each type and rating)	Electrical	A
107	BATTERY CHARGER (FLOAT CUM BOOST CHARGER)- TYPE TEST REPORTS.	Electrical	A
108	TYPE TEST REPORTS-- oil filled trf-for each rating of oil filled transformer	Electrical	A
109	Type test procedure for Oil Filled Transformer-each type and rating	Electrical	A
110	BATTERY - TYPE TEST REPORTS	Electrical	A
111	TYPE TEST REPORT FOR 33 KV SWITCHGEAR INCLUDING NUMERICAL RELAYS	Electrical	A
112	DG SETS - TYPE TEST REPORTS	Electrical	A
113	Type Test Report for HT cable	Electrical	A
114	TYPE TEST REPORTS - Dry type transformer	Electrical	A
115	Type test Procedure for motor (each type and rating)	Electrical	A
116	TYPE TEST REPORTS FOR LIGHTING PANELS and DBs	Electrical	A
117	Type Test Report of NSPBD	Electrical	A
118	TYPE TEST REPORT OF JUNCTION BOX - (All type)	Electrical	A
119	FAT PROCEDURE OF RELAY-LT SWITCHGEAR	Electrical	A

120	Type test Report - VFD panel for Mill Circuit Recycle Pump Motor	Electrical	A
121	HT CABLE JOINTING & TERMINATIONS KIT- TYPE TESTS REPORT	Electrical	A
122	DATASHEET AND GA FOR NSPBD	Electrical	A
123	TECHNICAL DATA REQUIREMENT SHEET- oil filled trf-for each rating of oil filled transformer	Electrical	A
124	DATA SHEETS FOR DG SET COMPLETE WITH ALL ACCESSORIES	Electrical	A
125	Datasheet and Cross Section Drawings for HT Power Cables	Electrical	A
126	RELAY CONFIGURATION & SETTINGS FOR HT SWITCHGEAR	Electrical	A
127	DATASHEET FOR 33 KV SWITCHGEAR INCLUDING NUMERICAL RELAYS	Electrical	A
128	Datasheet for Earthing & Lightning Materials	Electrical	A
129	GA,SLD and BOQ of DCFB	Electrical	A
130	Drawing for Power Distribution Panels	Electrical	A
131	GA,SLD and BOQ of ACFB	Electrical	A
132	Control Scheme for each type of HT Swgr module	Electrical	A
133	Type Test Reports for Bus Duct	Electrical	A
134	Type Test Reports for Local Starters	Electrical	A
135	GA and Wiring Local Control Panel (each type and rating)	Electrical	A
136	electrical Load list	Electrical	A
137	Drawing Local Push Button Station.	Electrical	A
138	STANDARD DRAWING FOR DUCT FABRICATION & SUPPORTING ARRANGEMENT	Air Conditioning	AA
139	GA OF AIR TERMINALS LIKE SUPPLY / RETURN AIR DIFFUSER / GRILL,ETC.	Air Conditioning	AA
140	PAC ROOM LAYOUT & AC DUCT LAYOUT FOR MAIN CONTROL ROOM	Air Conditioning	A
141	SPLIT AC SCHEDULE	Air Conditioning	AA
142	P & I DIAGRAM FOR A/C SYSTEM FOR MAIN CONTROL ROOM	Air Conditioning	A
143	DESIGN PHILOSOPY, HEAT LOAD CALCULATION FOR A/C SYSTEMFOR MAIN CONTROL ROOM	Air Conditioning	A
144	TECHNICAL DATA SHEET OF PACKAGED AIR CONDITIONERS	Air Conditioning	A
145	TECHNICAL DATA SHEET & G/A/ DRAWING FOR HEATER PACKAGE	Air Conditioning	AA
146	TECHNICAL DATA SHEET & G/A/ DRAWING OF PAN HUMIDIFIER	Air Conditioning	AA
147	TECHNICAL DATA SHEET & G/A/ DRAWING OF FRESH AIR FAN	Air Conditioning	AA
148	TECHNICAL DATA SHEET FOR HI-WALL & CASSETTE TYPE SPLIT AIR CONDITIONER	Air Conditioning	AA

149	TECHNICAL DATA SHEET FOR THERMAL & ACCOUSTIC INSULATION FOR DUCTING/PIPES	Air Conditioning	AA
150	TECHNICAL DATA SHEET & G/A/ DRAWING OF PRE-FILTER AND FINE FILTER	Air Conditioning	AA
151	TECHNICAL DATA SHEET & G/A/ DRAWING OF FIRE DAMPER WITH ACTUATOR	Air Conditioning	AA
152	DESIGN PHILOSOPHY, HEAT LOAD CALCULATION AND VENTILATION FAN SCHEDULE	Ventilation	A
153	TECHNICAL DATA SHEET & GA DRAWING FOR ROOF EXTRACTOR ALONGWITH FIXING DETAILS	Ventilation	A
154	TECHNICAL DATA SHEET & GA DRAWING FOR AXIAL FANS ALONGWITH FIXING DETAILS	Ventilation	AA
155	P & I DIAGRAM OF COMPRESSED AIR SYSTEM	Compressed air	A
156	P&I DIAGRAM FOR AIR COMPRESSOR & AIR DRYERS	Compressed air	AA
157	DESIGN PHILOSOPHY FOR COMPRESSED AIR SYSTEM ALONG WITH SIZING CALCULATION FOR COMPRESSOR	Compressed air	A
158	PG TEST PROCEDURE OF COMPRESSED AIR SYSTEM	Compressed air	A
159	O&M MANUAL-COMPRESSED AIR SYSTEM	Compressed air	AA
160	TDS & GA OF AIR COMPRESSOR, AIR DRYER & AIR RECEIVERS	Compressed air	A
161	TDS & GA OF VALVES FOR COMPRESSED AIR SYSTEM.	Compressed air	AA
162	ENGINE DOCUMENTS FOR ENGINE DRIVEN FIRE WATER PUMPS [GAD, DATASHEET,FUEL TANK DRAWING]	FDPS	A
163	GA OF FIRE WATER STORAGE TANK ALONGWITH NOZZLE ORIENTATION	FDPS	A
164	FABRICATION DETAILS FOR SHELL, BOTTOM AND ROOF PLATES ALONGWITH ROOF STRUCTURE AND STAIRCASE DETAILS OF FIRE WATER STORAGE TANKS	FDPS	AA
165	G.A. OF DELUGE VALVE HOUSING, CENTRAL HOSE STATION & VALVE CHAMBER	FDPS	AA
166	FDA LAYOUT FOR CONTROL ROOM, MCC, ETC.	FDPS	A
167	FDA & LHS CABLE LAYOUT FOR CABLE GALLERIES	FDPS	AA
168	DESIGN PHILOSOPHY AND WRITE-UP FOR INERT GAS SYSTEM	FDPS	A
169	EXTINGUISHER SCHEDULE	FDPS	AA
170	P&ID OF FIRE WATER PUMPING SYSTEM	FDPS	AA
171	P&ID OF HVWS & MVWS	FDPS	A

172	LAYOUT OF HYDRANT AND SPRAY SYSTEM FOR ENTIRE PLANT	FDPS	A
173	LAYOUT OF HVWS SYSTEM & HYDRAULIC CALCULATION	FDPS	A
174	LAYOUT OF INTERNAL HYDRANT FOR ALL BUILDINGS	FDPS	A
175	LAYOUT OF MVW SPRAY SYSTEM & HYDRAULIC CALCULATION	FDPS	A
176	BLOCK DIAGRAM AND PRESSURE DROP CALCULATION OF HYDRANT & SPRAY SYSTEM	FDPS	A
177	DESIGN CALCULATION FOR FIRE WATER STORAGE TANKS	FDPS	AA
178	DESIGN CALCULATION OF INERT GAS EXTINGUISHING SYSTEM FOR CONTROL ROOM	FDPS	A
179	DATASHEET AND GA DRG OF BASKET TYPE STRAINER	FDPS	AA
180	DATA SHEET - VALVES (GATE VALVE, BFV & CHECK VALVE)	FDPS	AA
181	GA & DATASHEET FOR MOTORISED GATE VALVE.	FDPS	AA
182	DATASHEET AND GA DRG OF HYDRANT VALVES, BRANCH PIPES AND NOZZLE AND 4-WAY VALVES, WATER MONITOR & MULTIPURPOSE NOZZLE	FDPS	AA
183	DATASHEET AND GA DRG OF FIRE HOSE (15 METER AND 7.5 METER) AND COUPLING	FDPS	AA
184	DATASHEET AND GA DRG OF HOSE BOX	FDPS	AA
185	GA & DATASHEET FOR DELUGE VALVE WITH TRIMS	FDPS	A
186	DATASHEET AND GA DRG OF Y-TYPE STRAINER	FDPS	AA
187	GA & DATASHEET FOR H.V.W.SPRAY NOZZLES, M.V.W.SPRAY NOZZLES & QUARTZOID BULB DETECTORS	FDPS	AA
188	DATA SHEET - PIPES & FITTINGS	FDPS	AA
189	TECHNICAL DATA SHEET OF FIRE EXTINGUISHERS	FDPS	AA
190	DATA SHEET & G.A. OF PRESSURE RELIEF DAMPER FOR INERT GAS PROTECTED AREAS	FDPS	AA
191	DATA SHEETS OF INERT GAS COMPONENTS (INDIGENOUS)	FDPS	A
192	DATA SHEETS OF INERT GAS COMPONENTS (IMPORTED)	FDPS	A
193	DATA SHEETS OF FIRE TENDERS & FIRE STATION EQUIPMENTS	FDPS	A
194	GA & WIRING DIAGRAMS OF FIRE PROTECTION SYSTEM (FPS) PLC	FDPS	A
195	DATA SHEET, BOQ & GA OF FIRE ALARM PANEL & REPEATER PANEL	FDPS	A
196	G.A. & WIRING DIAGRAM FOR DELUGE VALVE CONTROL PANEL	FDPS	A
197	DATA SHEET, G.A. & SCHEMATIC DRAWING OF BATTERY CHARGER & BATTERY FOR FPS PLC	FDPS	A

198	PANEL DOCUMENTS FOR ENGINE DRIVEN FIRE WATER PUMPS [DATASHEET, GAD]	FDPS	A
199	I/O LIST OF PLC SYSTEM	FDPS	A
200	INSTRUMENT SCHEDULE	FDPS	AA
201	SCHEMATIC DIAGRAM FOR FIRE DETECTION AND ALARM SYSTEM INCLUDING AREA DISTRIBUTION DETAILS	FDPS	A
202	FIRE ALARM PANEL NETWORKING DIAGRAM	FDPS	A
203	24V DC POWER DISTRIBUTION DIAGRAM FOR FPS PLC PANEL	FDPS	AA
204	FPS PLC - LOGIC DIAGRAMS	FDPS	A
205	FAT PROCEDURE OF FPS PLC	FDPS	AA
206	WRITE-UP AND CONFIGURATION DIAGRAM OF FPS PLC PANEL	FDPS	A
207	TYPE TEST REPORT OF LOOP CABLE	FDPS	AA
208	TYPE TEST REPORT FOR BATTERY & BATTERY CHARGER OF FPS PLC PANEL	FDPS	A
209	TYPE TEST REPORT OF FPS PLC	FDPS	AA
210	FPS PLC GRAPHICS & MIMICS	FDPS	AA
211	DATA SHEET AND GA DRAWING OF SIREN	FDPS	A
212	DATA SHEET & GA OF BATTERY FOR FIRE ALARM SYSTEM (WITH BATTERY SIZING CALCULATIONS)	FDPS	A
213	DATA SHEET OF DIGITAL LHS CABLE	FDPS	A
214	DATA SHEET OF DETECTORS / DEVICES	FDPS	A
215	GA & DATA SHEET FOR SOLENOID VALVE	FDPS	A
216	DATA SHEETS & BOQ OF FPS PLC ITEMS	FDPS	A
217	DATA SHEET OF FRLS CONTROL CABLE	FDPS	A
218	DATA SHEET OF OPTICAL FIBRE CABLE	FDPS	A
219	DATA SHEET - SHORT TERM FIRE SURVIVAL CABLE	FDPS	A
220	DATA SHEETS OF FIELD INSTRUMENTS	FDPS	A
221	DATA SHEET - ULTRASONIC LEVEL TRANSMITTER (FOR FIRE WATER STORAGE TANK)	FDPS	A
222	DATA SHEET - DIFFERENTIAL PRESSURE GAUGE & DIFFERENTIAL PRESSURE SWITCH	FDPS	A
223	DATA SHEETS FDA SYSTEM WORK STATION & PRINTER	FDPS	A
224	POWER SUPPLY CALCULATION OF FPS PLC & PANEL	FDPS	AA

225	OPERATION & MAINTENANCE MANUAL FOR FIRE DETECTION & PROTECTION SYSTEM	FDPS	A
226	Equipment Layout INCLUDING FOUNDATION PLAN, LOADING & FIXING DETAILS in Fire water pump house	FDPS	A
227	MQP Axial fan	QA	E
228	MQP Balancing Valves	QA	A
229	MQP Butterfly Valves	QA	A
230	MQP Centrifugal fan	QA	E
231	MQP Conventional Gate/Globe Valve/ Check Valve (Size >600 NB or Rating Pr Class > 300	QA	E
232	MQP Horizonatal Centrifugal Pumps	QA	E
233	MQP MS ERW Pipe (Black/GI)	QA	E
234	MQP Pipe-CS/SS seamless	QA	A
235	FQP - RECIEPT & STORAGE	QA	E
236	FQP - ERECTION	QA	E
237	MQP Axial/RE fan	QA	E
238	MQP Butterfly Valves	QA	A
239	MQP Centrifugal fan	QA	E
240	MQP Conventional Gate/Globe Valve/ Check Valve (Size >600 NB or Rating Pr Class > 300	QA	E
241	MQP Horizonatal Centrifugal Pumps	QA	E
242	MQP MS ERW Pipe (Black/GI)	QA	E
243	FQP - RECIEPT & STORAGE	QA	E
244	FQP - ERECTION	QA	E
245	MQP Air Dryer	QA	A
246	MQP Air receiver(≥ 10 bar pressure)	QA	A
247	MQP Ball valve/Plug valve	QA	E
248	MQP Conventional Gate/Globe Valve/ Check Valve (Size >600 NB or Rating Pr Class > 300	QA	E
249	MQP MS ERW Pipe (Black/GI)	QA	E
250	MQP Pipe-CS/SS seamless	QA	A
251	MQP Electric Hoist/EOT Crane/Chain pulley block (> 10 Ton)	QA	A
252	MQP Air Compressor	QA	A
253	MQP PIPE-CS/SS seamless	QA	A

254	FQP - RECEIPT, STORAGE AND ERECTION	QA	A
255	MQP Butterfly Valves	QA	A
256	MQP Conventional Gate/Globe Valve/ Check Valve (Size >600 NB or Rating Pr Class > 300)	QA	E
257	MQP MS ERW Pipe (Black/GI)	QA	E
258	MQP Pipe-CS/SS seamless	QA	A
259	MQP Dual Plate check valve	QA	A
260	MQP Submersible/Sump Pump	QA	A
261	MQP Wrapping & coating materials	QA	A
262	MQP Pipes & Fittings-CI and DI	QA	A
263	FQP - RECEIPT AND STORAGE	QA	E
264	FQP - ERECTION	QA	E
265	MQP-Gas Engine	QA	A
266	MQP for Alternator/Generator and Aux.	QA	A
267	MQP for Excitation System	QA	A
268	MQP for DG Set	QA	A
269	MQP for Cathodic Protection	QA	A
270	Quality plan for passenger cum goods elevator	QA	A
271	VFD PANELS	QA	A
272	MQP for HT Motors	QA	A
273	FIELD QUALITY PLAN FOR HV BUS DUCT (15.75 KV/ 21 KV)	QA	A
274	MQP for Isolated Phase Busduct & Accessories	QA	A
275	MQP for Segregated Phase Busduct & Accessories	QA	A
276	MQP FOR SWITCHGEAR PANEL (11KV & 3.3KV)	QA	A
277	MQP FOR DATA CONCENTRATOR PANEL & INTEGRATION	QA	A
278	MQP FOR Protection Panel (GRP/STRP)	QA	A
279	FAT of Numerical Relay	QA	A
280	MQP for Bus Transfer Panel	QA	A
281	MQP FOR LT SWITCHGEAR	QA	A
282	MQP FOR LT BUSDUCT	QA	A
283	BATTERY CHARGER - 220V	QA	A
284	220V BATTERY BANK - MQP	QA	A
285	MQP OF POLES	QA	A
286	QUALITY PLAN FOR CABLE TRAY SUPPORT STRUCTURE	QA	A

287	MQP-HT Cable	QA	A
288	QUALITY PLAN -LT XLPE Power Cable	QA	A
289	QUALITY PLAN-LT HRPVC Control Cable	QA	A
290	QUALITY PLAN for Cable Tray	QA	A
291	QUALITY PLAN - CABLE JOINTING & TERMINATIONS KIT	QA	A
292	QUALITY PLAN-LT FS POWER Cable	QA	A
293	FIELD QUALITY PLAN FOR CABLE FIRE SEALING SYSTEM TYPE],EPC ELECTRICAL EQUIPMENTS PACKAGE"	QA	A
294	QUALITY PLAN FOR AUX. SERVICE TRANSFORMERS	QA	A
295	MQP FOR LUMINARIES	QA	A
296	MQP FOR LDBS	QA	A
297	MQP FOR AUX. TRANSFORMERS	QA	A
298	Manufacturing quality plan for High Mast	QA	A
299	Manufacturing quality plan for Lighting Transformers	QA	A
300	Generator Transformer - MANUFACTURING QUALITY PLAN	QA	A
301	MANUFACTURING QUALITY PLAN---Shunt Reactor	QA	A
302	Quality Plan of Current Transformer	QA	A
303	Quality Plan of Capacitor Voltage transformer	QA	A
304	MQP FOR SURGE ARRESTER	QA	A
305	MQP FOR BUS POST INSULATOR	QA	A
306	MQP FOR CLAMPS AND CONNECTORS	QA	A
307	MQP FOR IPS AL TUBE	QA	A
308	MQP FOR DISC AND PIN INSULATOR	QA	A
309	MQP FOR ACSR CONDUCTOR	QA	A
310	MQP FOR ABT ENERGY METER	QA	A
311	MQP FOR CIRCUIT BREAKER	QA	A
312	MQP FOR SAS	QA	A
313	MQP FOR INSULATOR HARDWARES	QA	A
314	MQP for Dry Type Transformer	QA	A
315	MQP for UT	QA	A
316	MQP for UAT	QA	A
317	MQP for NEUTRAL GROUNDING TRANSFORMER	QA	A
318	MQP for Oil Purifying Equipment	QA	A
319	MQP for Composite Monitoring System	QA	A

320	WPS FOR TRF TANK	QA	A
321	WPS FOR BUSDUCT	QA	A
322	FIELD QUALITY PLAN FOR POWER TRANSFORMERS (GT, ST & UAT)	QA	A
323	QP OF 11 & 3.3 KV NGR	QA	A
324	QP-Local Control Panel (Electrical)	QA	A
325	MQP FOR LT MOTOR >50KW	QA	A
326	FQP for Gen. and Aux.	QA	A
327	FQP for Electrical works	QA	A
328	MQP FOR AAQMS	QA	A
329	MQP FOR Battery for UPS/ Battrey Charger	QA	A
330	MQP FOR IP Based CCTV	QA	A
331	MQP FOR Control Desk	QA	A
332	MQP for Control Valve	QA	A
333	MQP FOR Electrical Actuator (With gear box if applicable)	QA	A
334	MQP FOR Fiber optic cable	QA	A
335	MQP FOR Fire Alarm System	QA	A
336	MQP for Continous Emission Monitoring system	QA	A
337	MQP FOR Flame Monitoring System (Scanner)	QA	A
338	MQP FOR Instrument Cable	QA	A
339	MQP FOR LVS	QA	A
340	MQP FOR Master Slave Clock System	QA	A
341	MQP FOR PA System (IP Based)	QA	A
342	MQP FOR PLC System	QA	A
343	MQP FOR Pneumatic Actuator Regulating (Power Cylinder HAD,CAD SADC & Burner Tilt)	QA	A
344	MQP for UPS System	QA	A
345	FQP of material receipt, Storage and erection of C&I Items	QA	A
346	Solar PV(Photovoltaic)_Energy estimation and shadow analysis document	Solar	A
347	Solar PV(Photovoltaic)_Layout and Single line Diagram of Solar Plant on Rooftop	Solar	A
348	Solar PV(Photovoltaic)_Design calculation for module mounting structure	Solar	A
349	Solar PV(Photovoltaic)_Module Mounting Structure	Solar	A
350	Solar PV(Photovoltaic)_PG TEST PROCEDURE	Solar	A
351	Solar PV(Photovoltaic)_SPV Module Datasheet	Solar	I

352	Solar PV(Photovoltaic)_ Inverter GA/GTP/Type Test/Datasheet	Solar	A
353	Solar PV(Photovoltaic)_ DC cables Datasheet	Solar	I
354	Solar PV(Photovoltaic)_ AC Power cables Datasheet	Solar	I
355	Solar PV(Photovoltaic)_ Weather Monitoring Station Datasheet	Solar	I
356	Solar PV(Photovoltaic)_ Isolation Transformer GA/GTP/Type Test/ Datasheet	Solar	A
357	Solar PV(Photovoltaic)_ Lightning Protection System GA	Solar	A
358	Solar PV(Photovoltaic)_ O&M Manual	Solar	I
359	Process & Sizing Calculations for Desalination System (Including PT, DMF, UF, SWRO)	WS	A
360	P&ID for Desalination System (Including PT, DMF, UF, SWRO)	WS	A
361	P&ID for chemical dosing system including passivation & RO Cleaning & Flushing System for Desalination System	WS	A
362	Composite Layout for Water System Facilities such as Sea Water Tanks, Desalination System, Service Water System, ETP System etc.	WS	A
363	Equipment Layout of Desalination Plant, Effluent Treatment System including CMB	WS	A
364	Process Flow and mass balance diagram (Including Water balance)	WS	A
365	Sea Water Intake Piping Layout from Intake Pump House to Sea Water Storage Tank	WS	A
366	Piping Layout for RO Reject from Brine Tank to RO Reject Well & from RO Reject well to Outfall Structure in Sea	WS	A
367	GA Drawings for Various Tanks such as Sea Water Storage, RO Permeate Water, Service Water Potable Water etc.	WS	A
368	GA dwg for SWRO Skid including foundations & All Other Civil Inputs Details	WS	A
369	GA dwgs & Datasheet for all Membranes of Desalination System (Including PT, DMF, UF, SWRO - as applicable)	WS	A
370	Complete Valve Schedule with Material Specifications	WS	A
371	Complete Pipe Schedule with Material Specifications	WS	A
372	Painting Schedule & Specifications	WS	A
373	Data sheet, GA drawing, performance curves & cross sectional drawing for High Pressure Pumps for Desalination System	WS	A
374	Data sheet, GA drawing, performance curves & cross sectional drawing for All other Pumps for Desalination System	WS	A

375	Data sheet, GA drawing, performance curves & cross sectional drawing for other Pumps such as Sea Water Intake, Service Water, Potable Water, Effluent Transfer, Waste Disposal etc.	WS	A
376	Datasheet and GA Drawing for Tube settler Pack	WS	A
377	Operation & Control Philosophy for Various Systems of water system	WS	A
378	Mandatory Spares List for WS Facilities	WS	A
379	PG Test Procedure - Water system	WS	A
380	O&M Manual - Water system	WS	A

A -Approval

AA - Auto Archive

E- Endorsement

PART-B
VOLUME – VI
ROOFTOP SOLAR

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

Installation of Solar PV Rooftop on buildings

The Solar Photo Voltaic (PV) installation on Rooftop of various buildings of the Power Plant shall be carried out preferably on shadow free area in such a way that the generation is maximized on each building suitable for installation of Solar PV power plants.

For a shade free roof, the bidder has to install the solar PV rooftop system on the buildings in this package on the basis of maximum 15 square meter area per kWp. However, in case, chances of sporadic shade occurs, the installation shall be based on the shading profile and same shall be decided during detailed engineering.

The final plant capacity shall be as per detailed approved engineering design of each of the building's rooftops.

In all buildings where solar PV system is installed permanent Staircase access has to be provide with Mild Steel Stairs with minimum width of 1.0m & finished with primer & weather resistant enamel paint. In case the requirement of staircase in such building is already defined under the specification, then the same shall prevail. However, if the staircase specified is caged ladder type, then Mild Steel Stairs minimum width of 1.0m & finished with primer & weather resistant enamel pain has to be provided to access the rooftop building

1. SCOPE OF WORK

- 1.1 Determination of optimal grid connected roof-top Solar PV power plants capacity on all the Buildings listed above.
- 1.2 Complete design, engineering, manufacture, inspection, supply, transportation, storage, insurance, civil work, erection, testing, commissioning of the grid connected rooftop Solar PV plants including all auxiliaries.
- 1.3 All materials, manpower, scaffolding materials, machinery tools and tackles, transportation & loading/unloading, packaging and unpackaging, safe storage etc. shall be provided by Contractor. Scope shall cover all type of transportation of materials inside the working site and man power etc. required to execute and complete the work.
 - 1) Suitable arrangement for metering of output from each solar PV feeder.
 - 2) Termination of the solar PV feeder at owners' LT switchgear panels.
- 1.4 As per connectivity regulation for renewable energy plants notified by CEA, measurement of Total Harmonics Distortion, DC injection and Flicker at point of connection is to be done annually. Contractor shall arrange, on its own, one set of necessary measuring instruments on returnable basis and carry out these tests at least once during the O&M period.

TECHNICAL REQUIRMENTS (ROOF TOP SOLAR)

- 1.5 Providing a suitable Solar PV module cleaning & water washing system. Bidder shall also provide for water connection from the nearest service water line with necessary pumping arrangement and provide adequate number of water taps with isolating valves depending on the roof area.
- 1.6 During trial run (minimum one day), bidder to demonstrate trouble free operation of all the rooftop locations.
- 1.7 Facilitating statutory approvals related to the installation including CEIG clearance, if applicable, and associated incidental/logistic expenses.
- 1.8 Bidder to dispose of the packing material, surplus items, unused materials, waste etc. generated during EPC at location(s) identified by NTPC.

2. TECHNICAL SPECIFICATIONS

Solar PV system shall consist of following equipments/components.

1	Solar PV crystalline modules
2	Module Mounting Structures (MMS) and Civil Structures
3	String Monitoring Units
4	PCU / String Inverter
5	Transformers (if applicable)
6	Cables
7	Suitable metering arrangement 0.5 class MFM
8	Earthing and lightning protections
9	Conduits, pipes and accessories
10	Suitable ACB's/MCCB or LBS and ACDB's

3. SOLAR PHOTO-VOLTAIC (PV) MODULES

- 3.1 The Solar PV modules must conform to the latest edition of IEC 61215 / IS14286 for Crystalline Silicon Terrestrial PV Modules design qualification and type approval.
- 3.2 The capacity of each of the solar module shall not be less than 300 Wp and no negative tolerance from quoted power rating on solar module shall be allowed in any strings of the inverter
- 3.3 Module should have visual distinct identification mark based on the measured output in a band of maximum 5 Wp. The glass used for making module shall be 3.2 mm thickness for module upto 72 cell configuration. Each string shall have identical Wp rating Solar PV modules.

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

- 3.4 In addition, the modules must conform to IEC 61730 Part-1 - requirements for construction & Part 2 - requirements for testing for safety qualification or Equivalent IS. Module should also comply to IEC-61701 for salt mist testing
- 3.5 The offered Solar PV module design series as per type certificate must have been in successful operation for at least six months as on date of submission of Techno Commercial Bid.
- 3.6 Each PV module used must have a Radio Frequency Identification Tag (RFID) capable of withstanding harsh environmental conditions carrying technical details of the Module.

4. MODULE MOUNTING STRUCTURE (MMS)

- 4.1 Solar PV Module shall be suitably inclined to receive maximum insolation at the site. To accommodate more capacity and maximizing generation output, the angle inclination may be optimized to achieve the best performance requirements but not less than 12 deg. However, the overall layout of solar PV modules shall provide for minimum 1200 mm wide clear pathway along the roof parapet for facilitating easy access and movement of maintenance personnel with equipments. Inter row gap should be atleast 1000 mm
- 4.2 Module Mounting Structures must be suitable to mount the Solar PV Modules on the roof top, at an angle of tilt with the horizontal in accordance with the latitude of the place of installation preferably with a Fixed Tilt angle. The design calculations shall be supplemented with neat sketch and reference to various clauses of Technical specification and Indian standards. For MMS design analysis and determination of forces, where computer program (preferably STAAD) is used, the contractor shall submit a write-up on computer program used and its input and output data for review and approval of Engineer-in-Charge.
- 4.3 The Module Mounting Structure support and fixation arrangement shall be designed in such a way that it does not damage or deteriorate the strength, durability and performance of the roof including water proofing carried out on the roof.
- 4.4 Type of mounting arrangement shall be selected depending on the load bearing capacity of roof and applicable wind load at the roof level. For wind data, refer Wind Data as given in **Annexure A**.
- 4.5 The bidder shall provide module mounting arrangement with self-standing holding-down blocks/skids to be positively located right above the purlins of these buildings. Indicative support arrangement detail of solar panels on roofs with metal deck shuttering & on roofs with RCC slab are attached as **Annexure-C**.

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

- 4.6 In case offered support structure is of MS type then, the frames and the complete leg assemblies of the array structures shall be Hot Dip Galvanized. Thickness of galvanization will be IS-4759 or relevant standard. In case offered support structure is of Aluminum Alloy necessary protection shall be provided anodization. The grade of anodic coating shall be AC25 as per IS: 1868.
- 4.7 Module Mounting Structures shall be designed to withstand the extreme weather conditions in the area. The risk coefficient factor (K1) shall be taken as 1.05. The terrain factor (K2) and topography factor (K3) shall be as per IS 875 Part 3 (2015)
- 4.8 All fasteners including Nut & Bolts shall be of Stainless steel (minimum grade SS 304) for connection between MMS members. Other hardware will have to be adequately protected against all climatic condition by hot dip galvanization. All fasteners shall be provided according to the connection design requirement. All bolts shall be tighten with designed torque mechanically.
- 4.9 The complete MMS, suitable supporting base/foundation and connections shall be designed & submitted for NTPC approval before start of manufacture / fabrication of MMS.
- 4.10 The construction methodology shall also be submitted for NTPC approval before start of works.
- 4.11 Bidder shall also use principles governing design that shall prevent or reduce the risks of corrosion as per IS 9172 and relevant IS codes.

5. CABLES AND CONNECTIONS

- 5.1 The cables used in the system should be ISI marked PVC or XLPE insulated FRNC armored Copper/aluminum conductor. Cables of various sizes as per load requirement for connecting all the modules / arrays to Junction Boxes and from Junction Boxes to DC distribution box and from DC distribution box to inverter. Cables shall be armoured type if laid in switchyard area or directly buried
- 5.2 Cables for use at the DC-side of PV system shall meet the requirements of EN-50618 or other equivalent standard.
- 5.3 Suitable industrial Grade B rigid conduits shall be provided for cables connecting Solar PV array with Inverter. All cable entry to and from Inverter must be able to prevent access of rodents, termites and other insects into the Inverter.
- 5.4 The permissible voltage drop from the Solar PV Module to the Inverter shall not be more than 2% of peak power voltage of source.

TECHNICAL REQUIRMENTS (ROOF TOP SOLAR)

- 5.5 All electronic connections should be properly terminated, soldered and/or sealed from outdoor and indoor elements. Relevant codes and operating manuals must be followed.
- 5.6 Extensive wiring and terminations (connection points) for all Solar PV components is needed along with electrical connection to grid injection point.
- 5.7 Bidder can use existing cable tray and trestle subject to Owner's approval.

6. PCU / STRING INVERTOR

PCU/ String Inverter of minimum 90% of Solar Field name plate capacity should be provided to convert DC power produced by Solar PV modules to AC power. The PCU / String Inverter should be grid interactive and the output should be compatible with the grid frequency. Typical technical features of the PCU / String Inverter shall be as follows:

- 6.1 PCU/String Inverter shall be transformer less design with minimum euro efficiency of 97%.
- 6.2 PCU/String Inverter shall have MPPT features and may be selected in a way to keep string voltage within MPPT range under all temperature conditions from 10 deg to 50 deg ambient.
- 6.3 The PCU/String Inverter shall be suitable for parallel operation with Total Harmonics Distortion of current less than 4% at 50% load.
- 6.4 PCU/String shall be capable of operation at at design ambient temperature of atleast 50 deg C without any deration.
- 6.5 PCU/String Inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
- 6.6 Built-in meter at PCU/String Inverter and data logger to monitor plant performance through external computer shall be provided. Customized solar monitoring solutions available with Inverter manufacturer shall be preferred.
- 6.7 The PCU/String Inverters should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683 and IEC 60068.
- 6.8 The PCU/String Inverters should comply with IEC-61727 or IEC-62116 or equivalent standard for grid connectivity.

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

- 6.9 The protection class of electronics components of string inverter should be IP 65(for outdoor) and balance of system of string inverter shall be IP 54 (indoor). For other components i.e. ACDB, DCDB etc, the specification in the relevant clauses of the document shall prevail. The PCU / String Inverters should be tested from NABL/BIS accredited testing-calibration laboratories or MNRE approved test centre or international testing laboratories such as TUV, Intertek, UL etc.
- 6.10 Central PCU may be proposed only for Main power house building having final evacuation as shown in single line diagram of power evacuation. The Central PCU shall be indoor class of IP-40 or better. For all other buildings, only String Inverters may be specified. All PCU / String Inverters should be 3-phase inverters
- 6.11 In case combiner box is used, the enclosure shall be Flammability Fire Retardant, Halogen free and UV resistant with IP 55 class or better.
- 6.12 For Main power house, Central Inverter(s) may be installed and pool the power to two station service boards at 415 V as shown in line diagram at **Annexure-B**.
- 6.13 PCU / String Inverter shall have provision of taking auxiliary power supply from its own output terminals.

7. TRANSFORMER

Isolation/Step up/step-down Transformer shall be converter duty suitable for solar inverter application. The transformer shall be dry type of suitable voltage rating, 50 Hz shall be provided along with all protections, switchgears, circuit breakers, cables etc. and required civil work. The rating and vector group shall be as per inverter manufacturer recommendation. However one side of transformer winding connection shall be of delta type. Transformer should be highly efficient and capable of withstanding inverter DC &Harmonic injection.

If the output of the inverter matches to the switchgear voltage and suitable for directly connection to grid without galvanic isolation, the requirement of transformer may be omitted except Main Power House building, Switchyard building and Ash Slurry Pump house. Isolation transformer has to be provided in case, the inverter manufacturer recommends for connection to grid.

Dry Type Transformer shall be constructed in accordance to IS:2026, IS:11171, Indian Electricity Act 2003, BEE Guideline & CEA notifications and equivalent to any other international standard. Transformer rating and all related technical parameters

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

including tap changer (if applicable) shall be as per system requirement/SLD and relevant standards. Transformer shall be suitable for continuous indoor duty application. Transformer shall be complete & functional in all respect.

The other important construction particulars shall be as below.

- 7.1 The transformers shall be housed in a metal protective housing, having a degree of protection of minimum IP-42. The enclosure shall be provided with suitable hardware (as required).
- 7.2 The conductors shall be of electrolytic grade copper free from scales & burrs.
- 7.3 Dry Type Transformer windings shall be of class F insulation or better.
- 7.4 The core shall be constructed from non-ageing, cold rolled, grain oriented silicon steel laminations.
- 7.5 The maximum losses for dry type transformer shall not be more than the values specified in latest energy conservation building code (ECBC) of BEE.
- 7.6 The fittings/accessories including protection/monitoring device generally required for satisfactory operation of the transformer, are to be provided.
- 7.7 Suitable rain shed arrangement shall be provided to keep transformer under that arrangement
- 7.8 Painting shall be as per employers requirement(will be finalized during detailed engineering)
- 7.9 Type and routine test shall be conducted as per IS11171
- 7.10 In case the bidder/contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by client. In case the bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements the bidder shall conduct all such tests under this contract at no additional cost to the employer and submit the test reports

8. INTEGRATION OF SOLAR PV POWER WITH GRID

TECHNICAL REQUIRMENTS (ROOF TOP SOLAR)

- 8.1 In case of grid failure or low/ high voltage, Solar PV system shall be disconnected from the grid. Once the grid is energized / normalized, the Solar PV system shall again be automatically re-synchronized and load requirement would be met to the extent of availability of power.

The power evacuation voltage shall be at 415 V, 3-phase 4-wire system at all locations. (Please refer the proposed Single Line Diagram for power evacuation on different buildings at **Annexure-B**)

Contractor has to install Load break switch (LBS) or MCCB with CT, PT and Multi-functional Meter at transformer end. However for the solar PV system located at main power house, the contractor has to provide Air circuit Breaker with CT, PT and Multi-functional Meter at transformer end. The accuracy class shall be 0.5 for MFM. MFM must be suitable to withstand 2.0 kV (R.M.S.) test voltage. IP Class of the switchgear enclosure shall be IP - 55 or better

All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.

- 8.2 The interconnection point of the power from the solar plant shall be at nearest available 3 phase 415 V feeder which shall be decided during detailed engineering.

9 PROTECTIONS

- 9.1 The system should be provided with all necessary protections like Earthing, Lightning & Surge and Grid Islanding in accordance with the latest codes & standards and best industry practices.
- 9.2 Metallic frame of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity
- 9.3 Protection shall comply as per CEA's "Technical standard for connectivity of the distributed generation resources", Regulation 2013.

TECHNICAL REQUIRMENTS (ROOF TOP SOLAR)

10 DATA MONITORING:

Bidder has to aggregate Data as specified in Clause 10.1 from each Inverter to a Single PC in Control Room. However, irradiance / temperature sensor set can be provided at one of the rooftops. The plant monitoring shall have following,

- 10.1 Measurement of Solar PV parameters at String Inverter level: String Inverter shall have provision of measuring and displaying actual value of AC & DC Voltage, AC & DC Current, and AC Power & Energy Generated by the Solar PV system. These String Inverter parameters shall have provision of data logging through Mod Bus (RS-485) protocol.
- 10.2 Solar Irradiance: An integrating Pyranometer (Class II or better) shall be provided, with the sensor mounted on a Horizontal plane at a shadow free suitable location near solar arrays.
- 10.3 Temperature: Temperature probes for recording the PV Cell temperature shall be provided at one of the module at shadow free area

The above data has to be made available at separate terminal by integrating in the plant network. Bidder can utilized the available mode of data transmission. Any hardware required shall be included in the scope of work by the bidder.

11 CLEANING & WATER WASHING ARRANGEMENT FOR SOLAR PV PANELS

An appropriate Solar PV Module cleaning & water washing system complete GI pipes, valves, hose pipes, wipers, mops etc. shall be provided for regular cleaning and water washing of the rooftop Solar PV modules. Minimum two sets of Microfibre based cleaning tool is to be provided for each rooftop location. The system shall be specifically designed to take care of the harsh & dusty environment of thermal power plants. Drainage for this system shall be arranged by the bidder. Clean water shall be made available at the nearest point from where bidder to make necessary pumping & treatment, if required, and piping arrangements for water washing of PV modules

12 BALANCE OF SYSTEM (BOS) ITEMS/ COMPONENTS

The BOS items / components of the Solar PV plant(s)/ system(s) deployed must conform to the latest edition of IEC/equivalent BIS Standards

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

13 COMMISSIONING OF ROOFTOP SOLAR PV

Individual solar rooftop location is deemed to be commissioned after the completion all the facilities pertaining to scope of work of that rooftop location.

14 WARRANTY OF ROOFTOP SOLAR PV

Solar PV modules used in plant(s)/ system(s) must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years.

All the mechanical mounting system and structures along with String Inverters of the Solar PV plant must be warranted against any manufacturing, design and installation defect for a minimum period of one year years from date of successful trial run of all the rooftop locations.

TECHNICAL REQUIREMENTS (ROOF TOP SOLAR)

ANNEXURE-A

Wind Data

CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT

All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. Site specific information is given below.

Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard.

Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method.

Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz.

Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.

It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects.

No reduction in wind forces shall be considered due to parapet walls.

An increase in allowable stresses of structural material should not be considered during design analysis.

The Module Mounting structure and its foundation system design shall include at least the MMS Structural system design (structural members, bolts, base plates, anchors dead loads required etc.), check for uplifting of MMS structure, toppling of structure during wind loads and safety of supporting slab for downward reaction passing on the structure.

Damping in Structures

The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:

- | | |
|-----------------------------------|--|
| a) Welded steel structures | : 1.0% |
| b) Bolted steel structures | : 2.0% |
| c) Reinforced concrete structures | : 1.6% |
| d) Steel stacks | : As per IS:6533&CICIND Model Code whichever is more critical. |

TECHNICAL REQUIRMENTS (ROOF TOP SOLAR)

SITE SPECIFIC DESIGN PARAMETERS

The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:

- a) The basic wind speed “ V_b ” at ten metres above the mean ground level
: IS: 875 (Part-3)
- b) The risk coefficient “ K_1 ” : 1.05
- c) Category of terrain : Category-II

PG Test Procedure for Rooftop Building

The test shall be done for each location having different type of inverter

The month wise target Performance Ratio (PR) shall be determined during engineering stage based on the bidder’s technical proposal. The target PR shall be supported by energy estimation tool e.g. PVSyst, PVSol. The value of PR shall be determined as follow

$$\text{PR (\%)} = \frac{\text{AC Yield(KWh)}}{\text{Installed Capacity(kWp)} \times \text{Measured Global Inclined Insolation(kWh/m}^2\text{) during the period}} \times 100$$

The assumption for calculating PG Tests are as follow

- Temperature as per latest version from PVSyst
 - Soiling loss=3%
 - LID=2%
 - Cable loss=1.5%
 - Thermal Loss Factor (U_c, U_v)= U_c -24 Watts/m²-K U_v -2.0 Watts/m²-K
- PAN and OND file has to be furnished by the bidder. In case same is not available, PAN and OND file of equivalent product may be taken.
1. For the purpose of measuring Global horizontal Insolation (GHI), pyranometer shall be installed on returnable basis, mounted at the plane of the module, free of cost.

TECHNICAL REQUIRMENTS (ROOF TOP SOLAR)

2. Bidder also to install Single Quadrant type of 1.0 accuracy energymeter on all the location(s) based on mutual understanding.
3. In case 1.0 class energymeter is available in inverter, same shall also be accepted.
4. Both the additional supplied items i.e. pyranometer and energymeter shall be returnable basis and free of cost.
5. Measuring instruments to record on site data will include a pyranometers with sensitivity of $7\mu V/(W/m^2)$, temperature sensor, signal converter.
6. The Bidder will be responsible to conduct the PG test only after achieving the physical completion and synchronization of the plant and complying the relevant requirements from utility.
7. If failed to achieve the guaranteed performance levels, the contractor will at its own cost rectify all the defects identified during the test and take necessary steps/efforts to pass the PR test within the stipulated time span. Subsequent to rectification the PR will be restarted.
8. The test shall be conducted for a period of 60 minutes having GHI more than 600 W/m² and the Measured PR shall be determined as per the actual generation.

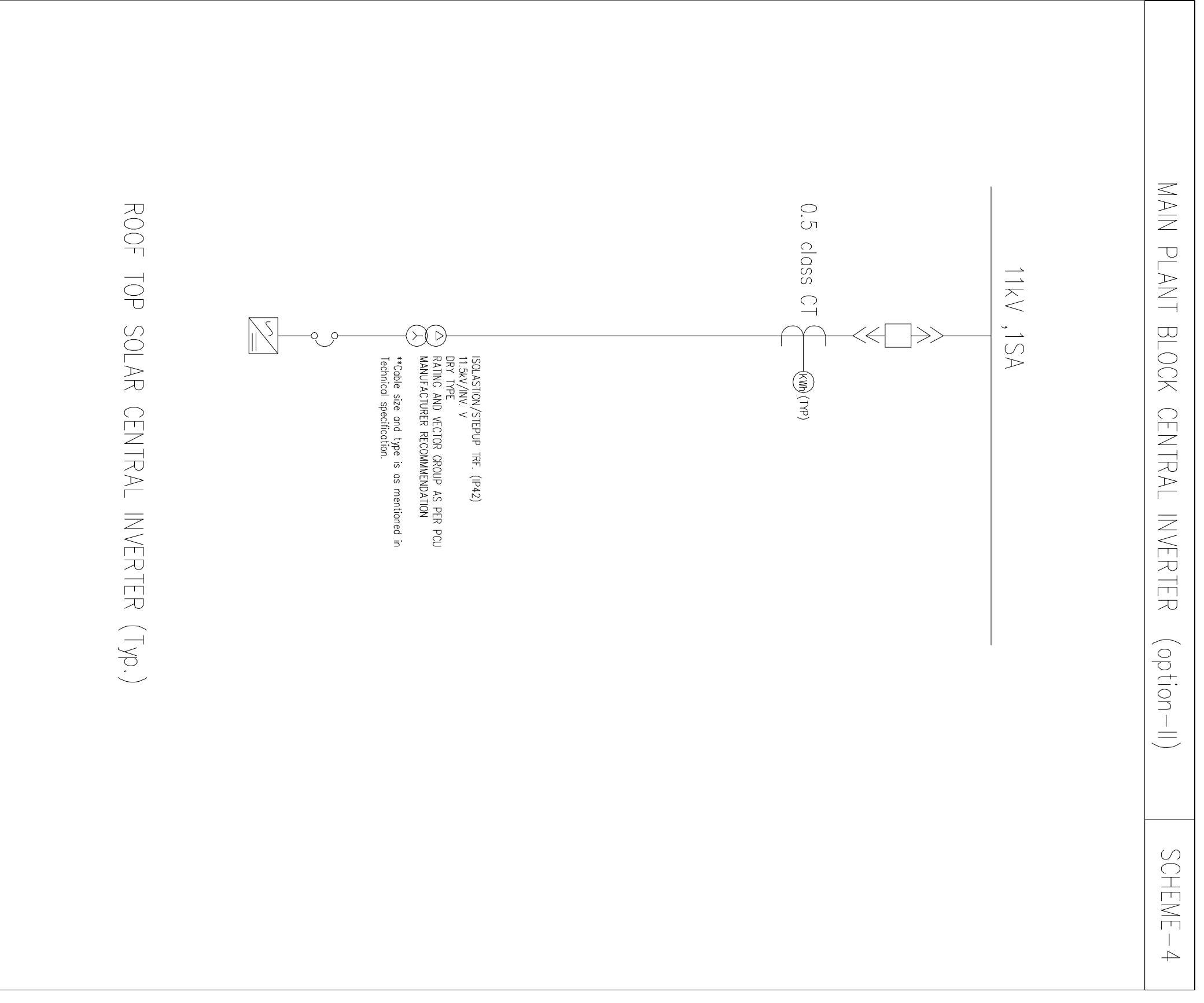
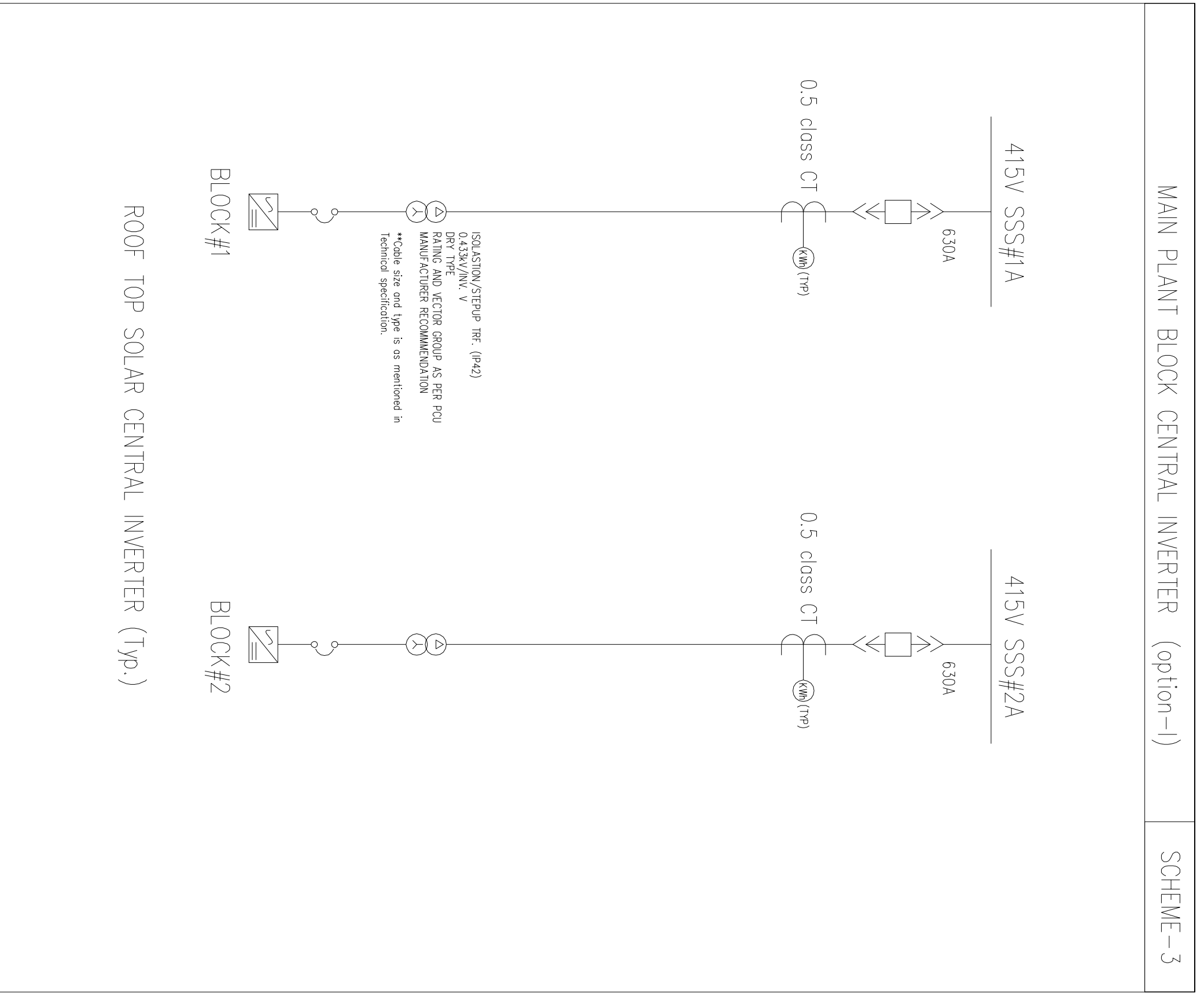
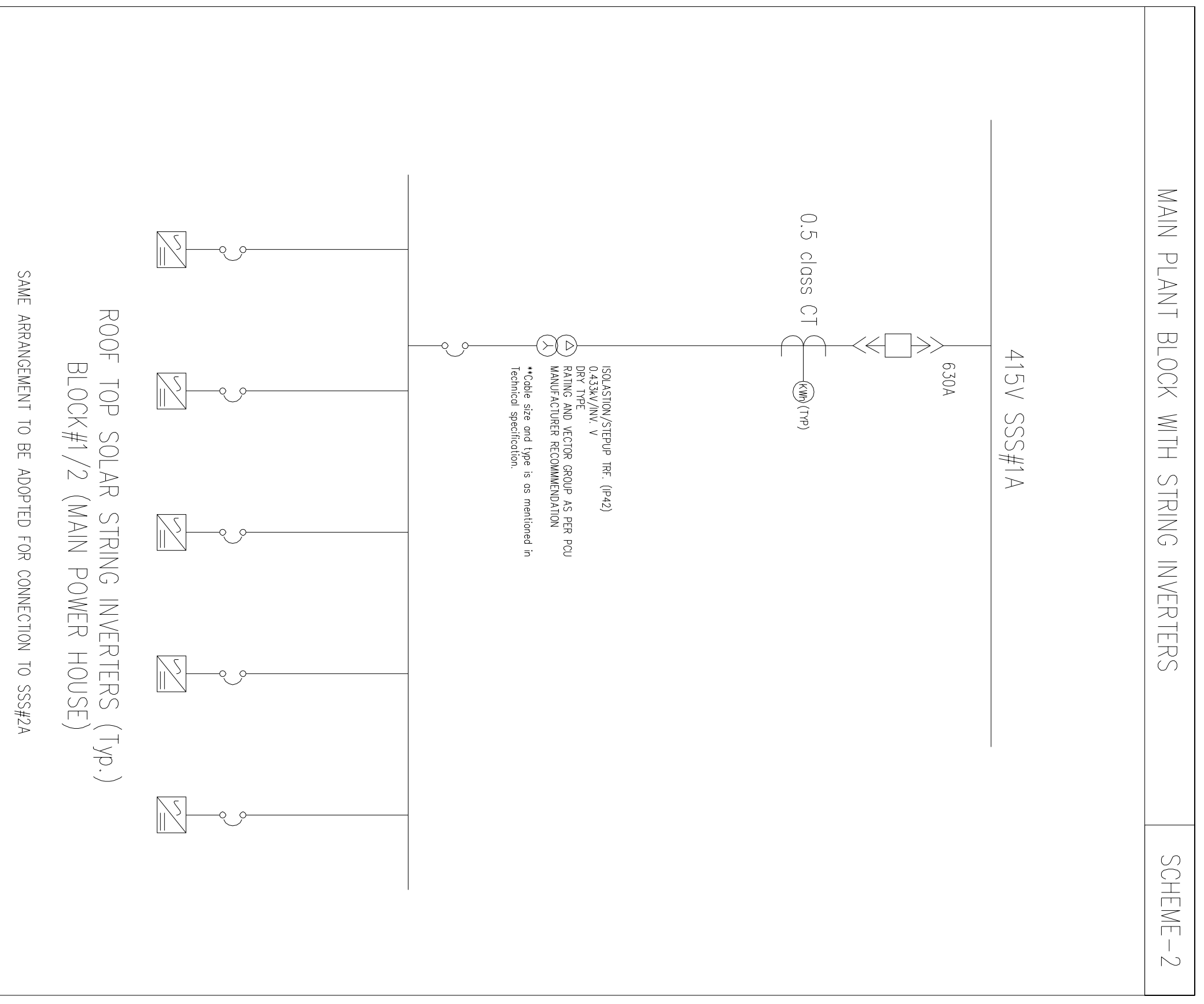
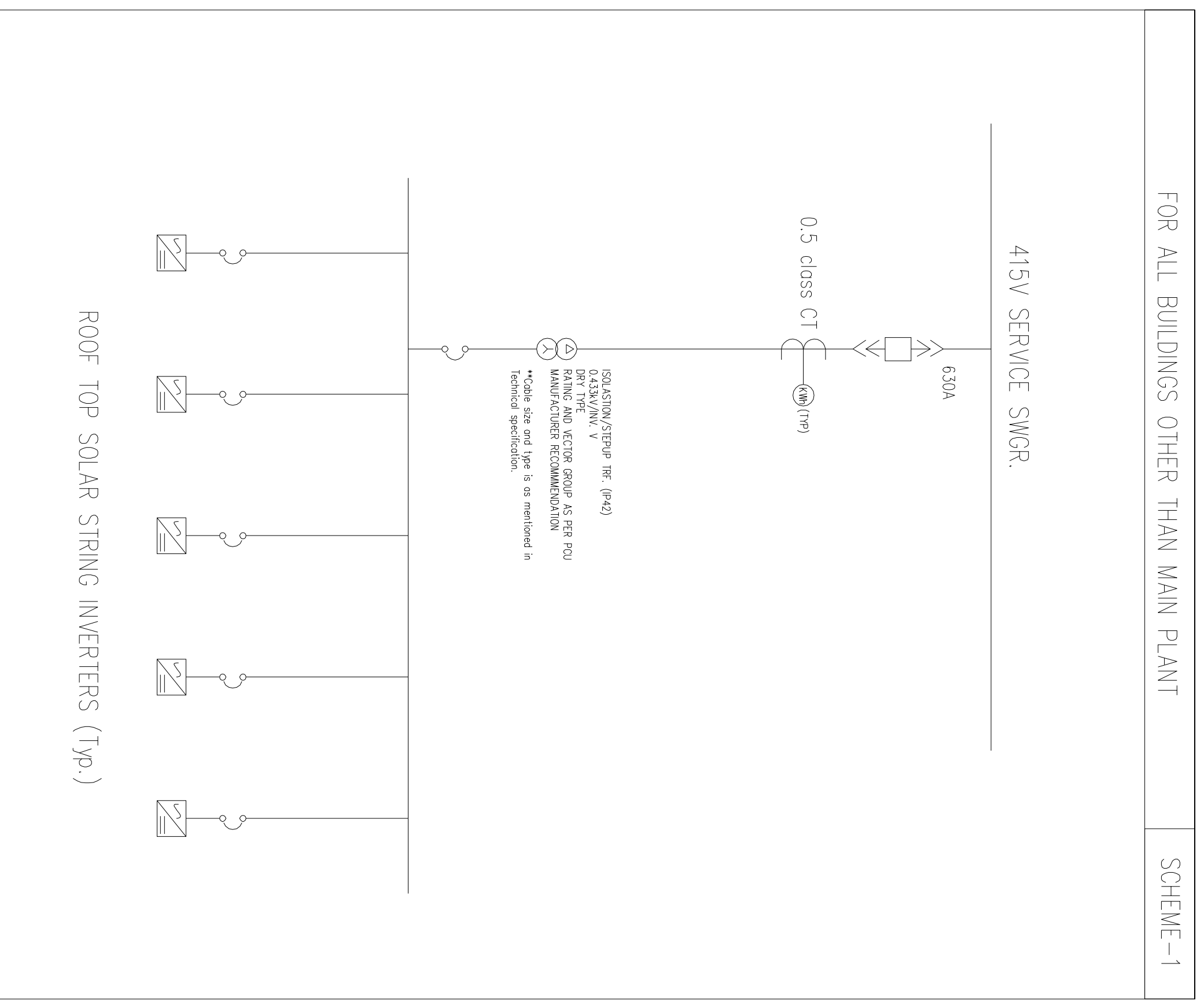
In case the measured PR is less than target PR, then

1. Contractor has to install additional module string equivalent to the percentage shortfall of PR.

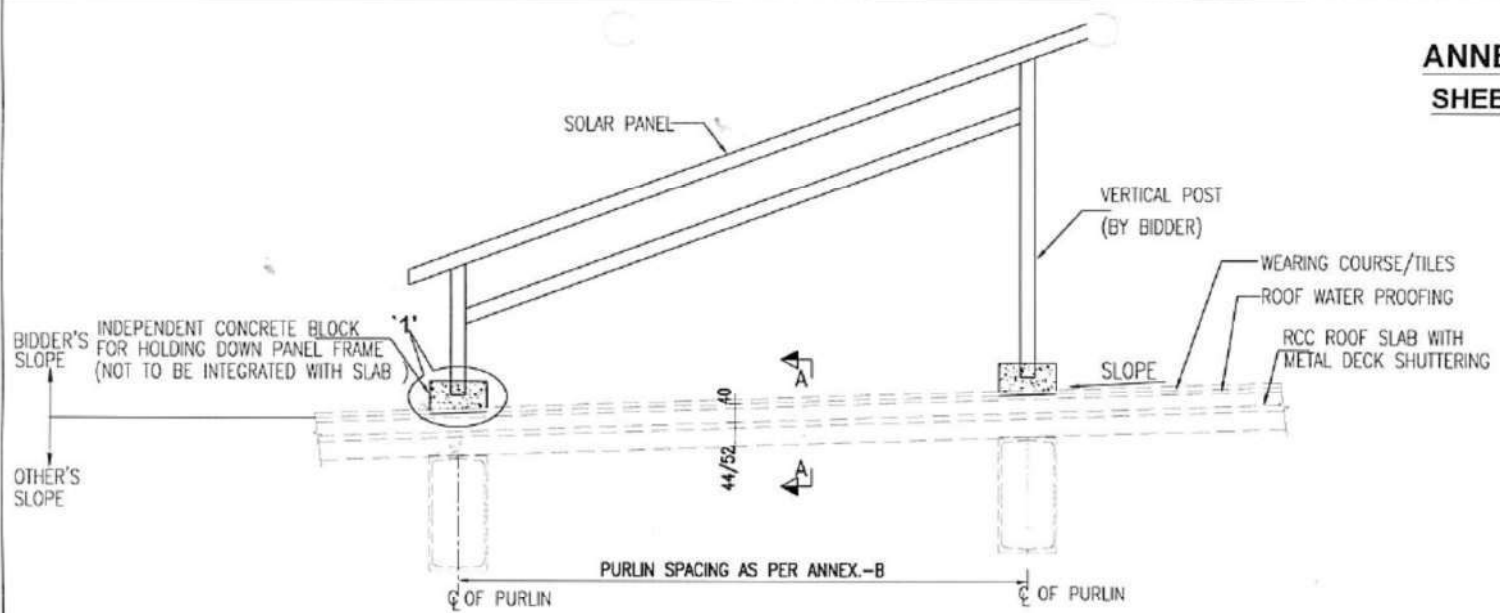
Or

2. In case there is no scope of any additional of module string, equivalent amount shall be adjusted from the contract value as

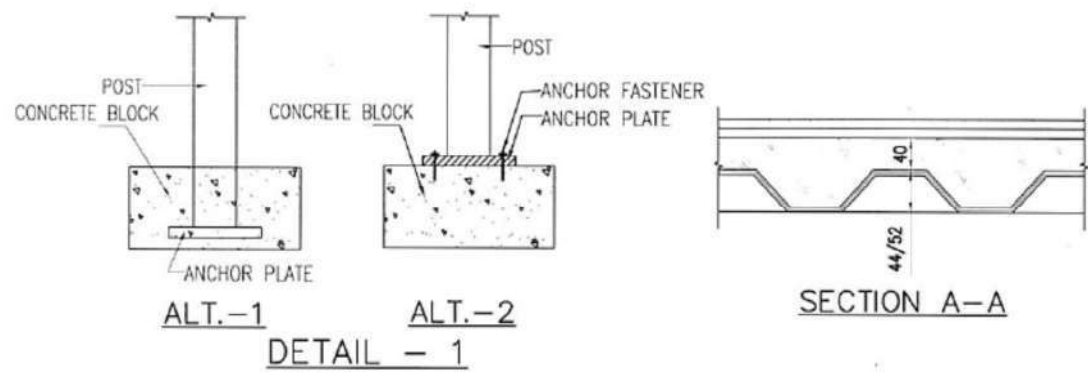
Applicable LD =	Target PR of the Month-Measured PR		× Contract Value
	(Target Prof of the Month)		



ANNEXURE-C
SHEET- 1 OF 2



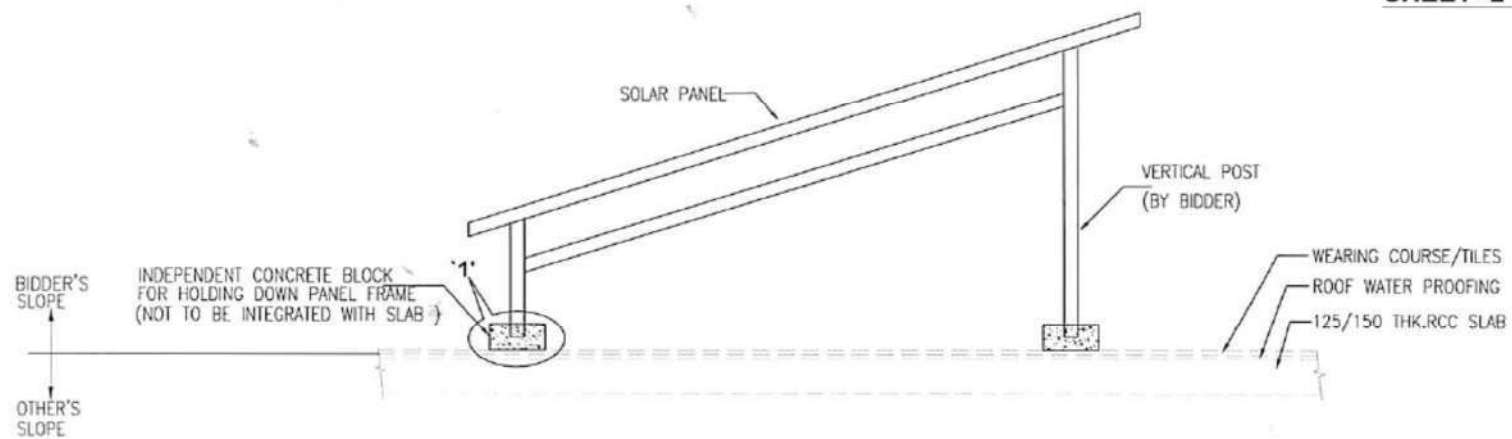
**INDICATIVE SUPPORT ARRANGEMENT OF
SOLAR PANEL ON ROOFS WITH METAL DECK SHUTTERING**
(FOR MAIN POWER HOUSE, PERMANENT STORES, WORKSHOP)



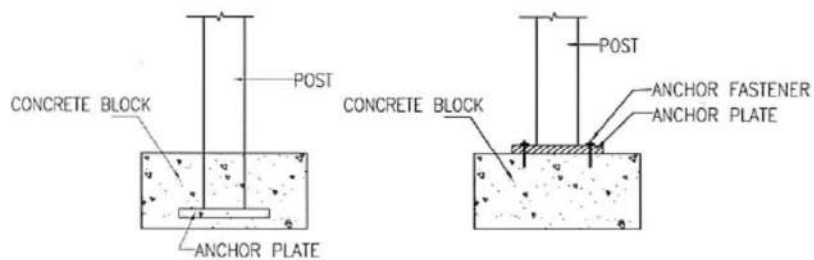
- NOTE:-
1. CONCRETE BLOCK FOR HOLDING DOWN PANEL FRAMES SHALL BE LOCATED OVER ROOF PURLINS.
 2. CONTRACTOR TO ENSURE THAT NO DAMAGE IS CAUSED TO ROOF & ROOF WATER PROOFING TREATMENT WHILE HANDLING OR INSTALLATION OF SOLAR PANELS

ALT.-1
ALT.-2
DETAIL - 1

SECTION A-A



INDICATIVE SUPPORT ARRANGEMENT OF SOLAR PANEL ON ROOF WITH RCC. SLAB



ALT.-1

ALT.-2

DETAIL - 1

NOTE:-

1. CONTRACTOR TO ENSURE THAT NO DAMAGE IS CAUSED TO ROOF & ROOF WATER PROOFING TREATMENT WHILE HANDLING OR INSTALLATION OF SOLAR PANELS

PART-B
VOLUME – VII
QA&I

Introduction to the Quality assurance specification

For fulfilment of the relevant clauses (Test and inspection) of the General Conditions of Contract and General Technical Requirements of Contract, the Quality Assurance Specification acts as a part of the Technical Specification and is included in the Contract.

This part of the Technical Specification shall be read in conjunction with other parts of the technical specifications, General Technical Requirements and Erection Conditions of the Contract.

This document specifies the quality requirements, to be detailed in terms of Tests/Checks/Procedures at the times of manufacturing, Testing, Inspection and also during installation of various Equipment / Components at the place of manufacturer and / or on the site.

Various standards referred in this document shall be the latest revisions.

The quality requirements are spelt out in the following ways;

- 1) Through description
- 2) In the form of tables

In either of the above two forms the test /checks / procedures are mentioned against particular item/ equipment/ component/ system etc.

This specification also contains the Indicative vendor list (with disclaimer) mentioned against particular item/ equipment/ component/ system etc.

The quality requirements specified in this document and also the vendor list are only indicative and not exhaustive.

ANDAMAN & NICOBAR GAS POWER PROJECT(50MW)-EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.:	SUB-SECTION- Q-00 INTRODUCTION TO QUALITY ASSURANCE SPECIFICATION	Page 1 of 3
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Disclaimer for Indicative Vendor List

- 1.1 Reasonable efforts have been made to collate the sub-vendors proposed by the various main contractors from time to time against different Projects/Packages and accepted by NTPC for various items. However, in case of error/omission, if any, and represented by the successful bidder this will be addressed during the execution of the contract based on the material evidence available with NTPC / Main Contractor.
- 1.2 The approved sub-vendor list drawn is not based on NTPC driven enlistment process but based on the sub- vendors proposed by various Main Contractors. As such, it is possible that some of the Suppliers/Manufacturers who may be involved in similar work/process may not be appearing in the list as such sub-vendors may not have been proposed by Main Contractors against NTPC Contracts.
- 1.3 In case the successful bidder chooses to propose additional sub-vendors with relevant experience after the award of the contract such sub-vendors will be considered in terms of Clause no: 19.1 of GCC, provided the proposals are received sufficiently in time: 90 days prior to ordering date of a Bought Out Items/Start of Manufacturing so as not to impede the progress of the contract.
- 1.4 Sub-vendors have been grouped under different categories of items. It is possible that an item characterized by certain specific features such as range and type required as per Main Contractor's design requirements may not be in the range of the listed sub-vendor's manufacturing process/capability. As such the main contractor to ascertain the vendor's capability to meet his specific requirements before considering a sub-vendor.

ANDAMAN & NICOBAR GAS POWER PROJECT(50MW)-EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.:	SUB-SECTION- Q-00 INTRODUCTION TO QUALITY ASSURANCE SPECIFICATION	Page 2 of 3
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- 1.5 It is to be noted by the bidders that any shortfall in contract performance attributable to the sub-vendor listed will not absolve the contractor from his contractual obligations in any manner.
- 1.6 The approval was granted based on the evaluation of relevant capabilities and facilities possessed by the sub-vendor at the time of evaluation. Also, some of the sub-vendors may not be active. As such, the successful bidder is to carry out his own due diligence before considering the listed sub-vendor for subletting: the current status of the sub-vendor, the continued availability of productive resources including Human Resources.
- 1.7 The list of sub-vendors is periodically revised to include new sub-vendors. Such a revision may also see a deletion of certain sub-vendors who may have been disqualified on grounds of inadequate performance or banned in line with NTPC's banning policy. The then current list will be shared with the successful bidder immediately on award.

<p>ANDAMAN & NICOBAR GAS POWER PROJECT(50MW)-EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.:</p>	<p>SUB-SECTION- Q-00 INTRODUCTION TO QUALITY ASSURANCE SPECIFICATION</p>	<p>Page 3 of 3</p>
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QUALITY ASSURANCE

QA& I REQUIREMENTS OF GAS ENGINES:

- 1.00.00 All materials shall be tested as per relevant national/international standard or manufacturer's internal plant standard meeting technical specification requirements.
- 2.00.00 Casting and forgings shall be NDT tested as per relevant national/international standard/manufacturer's internal plant standard meeting technical specification requirements.
- 3.00.00 Assembly and performance/run test shall be as per manufacturer's plant standard meeting technical specification requirements.
- 4.00.00 Gas system/Lube Oil/ cooling water system/Air Intake and Exhaust System/ Insulation & cladding and RLNG forwarding system/governing system(as applicable) shall be tested as per manufacturer's plant standard meeting technical specification requirements.
- 5.00.00 All the Engines along with associated auxiliaries shall be tested at the Factory.
- 6.00.00 Noise level shall be as per standards of MoEF & CC and Central pollution Control Board (CPCB), India/ technical specification requirements.

ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	VOLUME-VI CHAPTER-Q-01	PAGE 1 OF 1
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PUMPS

Items / Components	Material Test	DPT/MPI	Ultrasonic test	RT	Balancing	Hydraulic / Water Fill test	Pneumatic Test	Assembly/ fit up	Dimensions	Functional/operational Test	Performance Test	Other Test	All Test as per relevant Std/ Approved Data Sheets	Remarks
A. PUMPS:								Y ¹	Y		Y ²			
1 Shaft	Y ^a	Y ^b	Y ^c		Y				Y					
2 Impeller	Y ^a	Y ^b		Y ³	Y							Y ^d		
3 Suction Bell / Bowl Castings/ Inserts	Y ^a	Y ^b				Y			Y			Y ⁶		
4 Discharge Head / Column Pipes / Distance Piece/Base Plate	Y ^a	Y ^b	Y ^c	Y ⁴		Y		Y						
5 Companion Flanges	Y ^a	Y ^b	Y ^c	Y ⁵				Y						
5 Thrust Bearing (Tilting Pad type)	Y ^a	Y	Y					Y	Y				Y	

Notes:

a	One per Heat/ Heat Treatment Batch/ Lot.
b	On machined surfaces only for Castings / Forgings and on Welds of Fabricated Components.
c	For Shaft diameter ≥ 40 mm and for plate thickness ≥ 25 mm
d	Inter Granular Corrosion (IGC) Test shall be carried out on SS Castings.
1	Trial assembly of all Vertical Turbine Pump components with Column Pipes, Discharge Head, and Motor Stool shall be carried at shop.
2	All pumps shall be tested at rated speed, for head, flow capacity, efficiency and power consumption for the entire operating range i.e. from shut off head to maximum flow. A minimum of 7 readings shall be taken to plot the curve, with one reading at design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA/relevant standard. Performance test shall be carried out with contract motor, wherever Liquidated Damages are to be ascertained based on performance test as specified in Engg Technical Specification.
3	Not applicable
4	Random 10% RT to be conducted on butt welds for Thk ≥ 10 mm & ≤ 25 mm and 100% RT to be conducted on butt welds for Thk > 25 mm (RT may be replaced by Ultrasonic Test due to constraint if any.) Stress relieving shall be carried out as per norms of ASME Section VIII.
5	Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. (RT may be replaced by Ultrasonic Test due to constraint if any.) Maximum number of segments shall be 4 only.

6- No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.

PIPES, VALVES, FITTINGS AND SPECIALITIES

	Tests/Check Items / Components	Material Test	DPT/MPI / RT	Ultrasonic Test	WPS/ WQS/PQR	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Other Tests	All Tests as per relevant Std	REMARKS
1	Pipes & Pipe Fittings	Y ^a	Y ^b			Y ¹			Y			Y	
2	Diaphragm Valves	Y ^a				Y ⁵			Y		Y ⁶		
3A	Cast Butterfly Valves					Y		Y	Y	Y	Y ⁷		
	Body	Y ^a	Y ^b										
	Disc	Y ^a	Y ^b										
	Shaft	Y ^a	Y	Y ^c									
	EH Actuators	Y ^a	Y				Y	Y	Y		Y		
3B	Fabricated Butterfly Valves	REFER NOTE 14											
4	Gate/ Globe/Swing Check / Ball Valves	Y ^a	Y ^b	Y ^c		Y ⁵	Y	Y	Y	Y	Y ⁸		
5	Dual Plate Check Valves	Y ^a	Y ^b	Y ^c		Y	Y	Y	Y	Y	Y ⁴		
6	Rolled & Welded Pipes and Mitre Bends	Y ^a	Y ³		Y	Y ³			Y		Y ^{3&15}	Y	
7	Coating & Wrapping of Pipes	Y ²									Y ²		
8	Tanks & Vessels	Y ^a	Y ^b		Y	Y			Y		Y ¹⁶		
9	Strainers	Y ^a	Y ^b		Y [#]	Y					Y ¹¹		#For Fabricated
10	Rubber Expansion Joints	Y ^a				Y ¹²		Y	Y		Y ¹³		
11	Internal Lining of Pipes	Y ^a							Y		Y ⁹		
12	Site Welding		Y ¹⁰		Y	Y					Y ¹⁷		
13	Flexible Hoses	Test shall be carried out as per relevant standard.											

NOTES (MEANING OF SUPERSCRIPTS)	
a	One per heat/heat treatment batch/lot.
b	On machined surfaces only for castings and on butt welds.
c	For shaft/spindles > or = 40 mm
1	100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test shall be subjected to 100% RT.
2	Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221/IS 15337 as applicable.
3	Followings are the testing requirements for fabrication of pipes at site
TESTS	
QUANTUM OF CHECKS	
WPS, PQR, Welder Qualification Test	100% Welders and WPS shall be qualified as per ASME-section IX
DPT on root run	100% for pipes up to 1200 mm diameter
DPT after back gauging	100% for pipes above 1200 mm diameter
RT / UT by TIME OF FLIGHT DEFRACTION (TOFD) Technique	5% (100% of T Joints)
DPT on finished butt weld joints	10%

CLAUSE NO.	QUALITY ASSURANCE WATER SYSTEM			
	Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher.		
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be submitted for review as applicable.			
5	Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.			
6	Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted.			
7	Hydraulic Test of Body, Seat and Disc strength shall be carried out in accordance with latest edition of AWWA C-504. Actuator operated Valves shall be checked for Seat Leakage by closing the Valve with Job Actuator. Seat Leakage test shall be carried out in both directions. For Proof of Design Test refer respective chapters of engineering portion in the technical specification.			
8	Blue matching, wear travel for gates, valves, pneumatic seat leakage, and reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review as applicable. Functional checks of the valves for smooth opening and closing shall also be done. Valves shall be offered for hydro test in unpainted condition. Anti-corrosive protection shall be tested as per applicable code.			
9	Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application.			
10	10% of welds (Root and finished welds) shall be subjected to DPT. (100% DPT for compressed air line and boiler & deaerator fill line.).			
11	Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review as applicable.			
12	During Hydraulic & Vacuum test at 30 mm Hg absolute in 3 different positions, the change in Circumference of the Arch should not be more than 1.5%. Permanent Set, after 24 hours of the test, should not exceed 0.5% of Arch.			
13	Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.			
14	In addition of all tests as indicated for Cast Butterfly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butterfly Valve: <ul style="list-style-type: none"> a. UT as per ASTM A-435 on plate material for body and disc shall be carried out for plate thickness 25mm and above. b. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joints of thickness 20mm & above of body and disc. 10% DPT on other welds shall be done. c. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. d. Welders and WPS shall be qualified as per ASME- section IX 			
15	Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT. Segmental flanges exceeding 37.5 mm thickness shall be stress-relieved as per norms of ASME Section VIII after welding			
16	For pressure vessel welds, RT shall be done as per design code requirements.			
17	Welders and WPS shall be qualified as per ASME- section IX			
ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART- B	SUB-SECTION-Q-02A WATER SYSTEM	PAGE 3 OF 3

QUALITY ASSURANCE

1.00.00 FIRE DETECTION & PROTECTION SYSTEM

1.01.00 HYDRANT SYSTEM: Shop Tests

1.01.01 Hydrant Valve:

- (a.) All valves shall be hydro tested for body and seat.
- (b.) Capacity test / flow test shall be done as per relevant standard.

1.01.02 Water Monitor, Hoses, Branch Pipes, Couplings and Nozzles:

- (a.) All tests including hydraulic test shall be done as per relevant Indian / International standard.

1.01.03 For Pumps, Diesel Engine, refer the requirements are indicated separately.

1.02.00 HIGH / MEDIUM VELOCITY WATER SPRAY & SPRINKLER SYSTEM: Shop Tests

1.02.01 For Pipes, Fittings, Valves and specialties, requirements are indicated separately.

1.02.02 Deluge Valves, Alarm Valves and Spray Sprinkler Nozzles

- (a.) All valves shall be hydro tested for body and seat.
- (b.) Performance test / functional test of 'Deluge Valves', 'Alarm Valves' and 'Spray Nozzles' shall be carried out.

1.02.03 **Detectors:** All 'Detectors' shall be tested as per relevant Indian / International Standards. Detectors shall also meet the requirements of UL / FM / LPC/VDS etc.

1.03.00 HORIZONTAL CENTRIFUGAL PUMP:

1.03.01 SHOP TESTS

- (a.) UT on Pump Shaft (≥ 50 mm dia) and MPI / DPT on Pump Shaft and Impeller shall be carried out.
- (b.) All rotating components of the pumps shall be statically and dynamically balanced as per ISO: 1940 Gr. 6.3 or better.
- (c.) Hydraulic test shall be conducted on pump casing with water at 1.5 times the shut off pressure or twice the rated pressure whichever is higher for a minimum duration of 30 minutes.
- (d.) Performance test and Standard Running test:
 - (1.) All the pumps shall be tested in the manufacturer's works for capacity, efficiency, head and brake horsepower. Pump shall be

QUALITY ASSURANCE

given running test over the entire operating range covering the shut off head to the maximum flow. The duration of test shall be minimum one hour. A minimum of five readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pump shall be in accordance with stipulations on Hydraulic Institute Standard (HIS) and / or as per applicable Indian Standard or equivalent. Tolerance of parameters shall be as per HIS.

- (2.) The test shall be conducted at the rated speed preferably with the type tested contract drive motor being furnished. However, in case of any limitation test bed motor duly calibrated can also be used.
- (3.) Noise and vibration shall be measured.
- (4.) Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level / vibration performance are observed during the shop test.

1.04.00 COMPRESSION IGNITION DIESEL ENGINE

1.04.01 Shop Tests:

- (a.) All pressure parts shall be subjected to hydraulic pressure tests at 1.5 times the design pressure.
- (b.) All Diesel engine shall be performance tests as per relevant IS / equivalent code.

1.04.02 Performance Test :

Performance test of diesel engine shall be carried out as per BS-5514 to determine the rated power and specific fuel consumption and governor's function. Performance test of engine in shop shall be done with actual job accessories for minimum four hours (three hours for full load and one hour for over load at 110% of

full load). All the engine parameters like RPM, inlet air temp and pressure, water inlet and outlet temp. And pressure, lub. Oil pressure, fuel consumption, ambient condition shall be measured and recorded for every half an hour. No positive tolerance shall be allowed on the specific fuel consumption (contractor to specify in the offer.)

1.05.00 STORAGE VESSELS: Shop Test

1.05.01 Atmospheric Tank

- (a.) All weld joints shall be DP Tested and complete tanks shall be water fill tested.
- (b.) All atmospheric storage tanks fabricated and erected at site shall be subjected to all tests (Hydro, NDT, and Vacuum) according to design code as applicable.

1.07.00 PIPING, VALVE AND SPECIALITIES

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1.07.01 SHOP TESTS

- (a.) All pipes and fittings shall be tested as per applicable code.
- (b.) DPT of pipe welds (in case of rolled and welded pipes only) shall be carried out for root and finished welds.
- (c.) All strainers shall be subjected to hydraulic pressure test for leakage and Pressure drop v/s Flow for each type and size.
- (d.) All valves shall be hydraulically tested for body, seat and back seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.
- (e.) Valves shall be offered for hydro test in unpainted condition.
- (f.) Functional checks of the valves for smooth opening and closing shall also be done.
- (g.) Anti-corrosive protection shall be tested as per applicable code.

1.08.00 FOAM SYSTEM:

1.08.01 SHOP TEST

- (a.) For tanks, pipes, fittings, valves and specification refer respective section of this specification.
- (b.) System shall meet any other test requirements as specified in TAC / UL / FM / NFPA / VDS etc.

1.09.00 PORTABLE & MOBILE FIRE EXTINGUISHERS

1.09.01 SHOP TEST

- (a.) All fire extinguishers shall be tested as per relevant standard.
- (b.) Performance / function test shall be carried out on sampling basis as per relevant code / standard.

1.10.00 EOT Crane

- a) Chain pulley Blocks shall be tested as per IS: 3832.
- b) Electrical wire rope hoists shall be tested as per IS : 3938
- c) Following NDT requirements shall be met:
 - (i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression.

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- (ii) DP at random on all weldments.
- c) Deflection, load, overload & travel check on EOT crane assembly shall be carried out as per IS: 3177.

1.11.00 SITE TESTS:

- (a.) Fire Extinguishers: A performance demonstration test at site of five (5) percent or one (1) number, whichever is higher, of each type and capacity of the extinguisher shall be carried out by the contractor. All consumables and replaceable items require for the contractor without any extra cost to employer would supply this test would be supplied by the Contractor without any extra cost to employer.
- (b.) Foam System :
 - (1.) The operation of the foam generation shall be demonstrated by the Vendor after installation either in the tank to be protected or in the dyke area.
 - (2.) Any other equipment found necessary for the demonstration of the above testing like portable foam water monitor hose etc. shall be provided by the contractor during testing.
- (c.) Piping Protection:
 - (1.) Thickness, Holiday by spark test, Adhesion test shall be carried out as per relevant standard.
 - (2.) Complete piping shall be Hydro pressure tested, at 1.5 X DP or 2 X MWP whichever is higher, before protection.
- (d.) Welding of Pipes:
 - (1.) ERW Black / rolled welded:

100% DPT on root of butt and finish weld of butt and fillet.

RT on 10% randomly selected joints shall be carried out (for underground piping).
 - (2.) GI Pipes

Welding on GI Pipes in general shall not be done. Welding of GI Pipes, if permitted by design, (butt / socket / fillet weld) shall be done strictly as per approved drawing and procedure approved by NTPC Engineering. For all such welds 100% DP test and random 1% RT shall be done.

AIR CONDITIONING & VENTILLATION SYSTEM PACKAGE

CLAUSE NO	QA MODULE FOR AIR CONDITIONING AND VENTILATION SYSTEM
1.00.00	PACKAGED AIR CONDITIONAER /SPLIT/CASSETTE / WINDOW AC/ /PEC
1.01.00	Split/Cassette/ Window AC will be accepted on the basis of Manufacturer Standard Guarantee and Warrantee certificate.
1.02.00	PAC/PEC: Each Unit shall be subjected to production routine Test excluding performance test carried out as per relevant standard.
1.03.00	Performance test of PAC/PEC shall be carried out as per relevant standard on one unit of each type and rating at site.
2.00.00	FANS
2.01.00	20% DPT of welding on fan hub, blades, casing and impeller as applicable shall be carried out.
2.02.00	DPT of fan shafts shall be carried out after machining.
2.03.00	UT of fan shafts (diameter equal to or above 40mm) shall be carried out.
2.04.00	Rotating components of all fans shall be dynamically balanced to ISO-1940 Gr. 6.3
2.05.00	All Fans shall be subjected to run test for 4 hrs. or till temperature stabilization is reached. Vibration, Noise level, Temp. rise and current drawn shall be measured during the run test.
2.06.00	One fan of each type and size will be performance tested as per corresponding BIS /AMCA for Air flow, Static Pressure, Speed, Efficiency, Power Consumption, Noise, Vibration and Temp. Rise.
3.00.00	AIR HANDLING UNIT
3.01.00	For Fans refer tests as mentioned at 2.00.00
3.02.00	One per type of assembled AHU (AHU casing and fan assembly) shall be subjected to free run test. Noise, Vibration and Temp. Rise of bearing shall be measured during run test.
3.03.00	All cooling coil shall be pneumatically tested and no leakage shall be permitted.
4.00.00	CENTRIFUGAL PUMP
4.01.00	UT on pump shaft (dia equal to or above 40 mm) and MPI/DPT on pump shaft and impeller after machining shall be carried out.
4.02.00	All rotating components of the pumps shall be dynamically balanced to ISO-1940 Gr. 6.3
4.03.00	A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the shut off pressure on the head characteristics curve or twice the rated pressure whichever is higher, for a minimum duration of 30 minutes.
4.04.00	Standard Running Test
4.05.01	All pumps shall be tested in the manufacturer's works preferably with contract motor for capacity, efficiency, head and brake horse power. Pump shall be given running test over the entire operating range covering from the shut-off head to the maximum flow. The duration of test shall be minimum one (1) hr. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standard (HIS) and/or as per applicable Indian Standard or equivalent. Acceptance norms shall be as per approved datasheet & HIS standard only.

AIR CONDITIONING & VENTILLATION SYSTEM PACKAGE

4.05.02	Noise and vibration shall be measured at shop for reference purpose only.
4.05.03	Pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and/or excessive vibration are observed during the shop test.
4.05.04	NPSH test shall be conducted with water as the medium, if required as per approved data sheets.
5.00.00	LOW PRESSURE AIR DISTRIBUTION SYSTEM
5.01.00	Functional test for fire damper along with solenoid shall be done.
5.02.00	Prototype tests report of fire damper (duly approved/accepted by owner / owner's representatives.) for each type and size as per UL-555 for fire rating shall be furnished.
5.03.00	Site Test- After completion, all ducting system shall be checked/tested for air leakages/tightness (smoke test) at site.
6.00.00	INSULATION
6.01.00	Insulation material shall be tested for all mandatory tests only as per relevant code/standard.
6.02.00	Thermal conductivity tests (for thermal insulation only) shall be done once in 12 months for insulation material manufactured during 12 months period for the same density and thickness of material as applicable as per IS:3346 or equivalent standard.
6.03.00	XLPE/Nitrile Rubber: Thermal conductivity tests (for thermal insulation only) shall be done as per relevant code for the same density and thickness of material and validity of test shall be as per relevant standard.
7.00.00	FRP/PACKAGED COOLING TOWER
7.01.00	UT of fan shaft and drive shaft (dia equal to or above 40mm) shall be carried out.
7.02.00	DPT of fan hub and shafts shall be carried out after machining.
7.03.00	Color of fills shall be as per approved data sheet.
7.04.00	Fan assembly shall be statically/dynamically balanced.
7.05.00	Cooling Towers being supplied to site in assembled condition shall be subjected to run test at shop to measure FAD, Noise & Vibration. For Cooling Towers being supplied in knocked-down condition, these tests shall be done at site.
8.00.00	AIR FILTERS
8.01.00	Pre/Fine filters shall be tested for initial and final pressure drop Vs flow and average synthetic dust weight arrestance as per the requirement of BS 6540/ASHARE-52-76/EN779. HEPA (Absolute) filters shall be tested as per applicable code.
9.00.00	PIPES & FITTINGS
9.01.00	All pipes and fittings shall be tested as per applicable codes / standard.
9.02.00	Site test- Pipes shall be tested at site hydraulically/pneumatically as per application requirement

AIR CONDITIONING & VENTILLATION SYSTEM PACKAGE

10.00.00	VALVES & SPECIALTIES
10.01.00	Visual and dimensional check of valves as per relevant codes and approved drawing.
10.02.00	All the water line valves shall be hydraulically tested for body, seat and back seat (wherever provided) as per the relevant standard to which these valves are supplied irrespective of the working pressure for which these valves are selected. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.
10.03.00	Refrigerant line valves shall be pneumatically tested for body and seat leakage test.
10.04.00	Valves shall be offered for hydro test and pneumatic test in unpainted condition.
10.05.00	Functional check of the valves for smooth opening and closing shall be done.
10.06.00	Performance test to check pressure drop Vs flow shall be carried out for one valve of each type, size and rating for 'Balancing Valve'/Globe Valves with orifice.
11.00.00	Air Washer and Unitary Air Filter (UAF)
11.01.00	Random 10% DPT on weld joints shall be carried out
11.02.00	Hydraulic test of pressure parts at 1.5 times the design. Pressure and water fill test of tanks shall be carried out
11.03.00	Trial assembly of Air washer/UAF for one of each size shall be done in shop.

CLAUSE NO.	QUALITY ASSURANCE		
1.00.00	<u>AIR COMPRESSOR SYSTEM</u>		
1.01.00	AIR COMPRESSORS: <ol style="list-style-type: none"> a) All pressure parts shall be hydraulically tested at not less than 150% of design pressure prior to painting and lining, if applicable. The test pressure will be maintained for 30 minutes. b) All other parts including inter-connecting piping shall be hydraulically tested wherever possible, as per relevant codes. c) Ultrasonic testing shall be carried out on all forgings and shafts (if dia.> 40mm). MPI/DP test will be done on machined areas of the above components. e. Rotor shall be statically and dynamically balanced. 		
1.01.01	PERFORMANCE TEST (SHOP TEST) : <ol style="list-style-type: none"> a) Performance test on the compressors shall be carried out in accordance relevant standard. The test shall also include demonstration of Capacity, Discharge Pressure, Power Consumption, loading & unloading mechanism (Capacity control) and operation of safety valves. b) Power consumption at motor input terminal at rated capacity as well as at fully unloaded condition of all the compressor shall be measured. c) Vibration and noise level measurement will be done during shop performance test. d) Test shall be carried out on all compressors with contract drive motor where power consumption for compressors has been indicated as a guaranteed parameter. 		
1.02.00	AIR RECEIVER, HEAT EXCHANGERS, MOISTURE SEPERATORS, AIR DRYING PLANT: <ol style="list-style-type: none"> a) Each finished vessel shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes. b) NDT on weld joints shall be as per respective code requirements or the minimum as specified below: <ol style="list-style-type: none"> (i) 100 % DPT on root run of butt welds. (ii) 100% DPT on all finished butt welds and fillet welds (iii) 10% RT on butt welds which shall include all T- joints. c) Tube to Tube sheet joint of the heat exchangers shall be subject to Mock-up test as per the relevant standards. 		
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CLAUSE NO.	QUALITY ASSURANCE		
1.04.00	<p>d) Reactivation blowers shall be tested for FAD, temp. rise noise & vibration. Rotating parts shall be dynamically balanced.</p> <p>e) Completely assembled ADP shall be pneumatically tested at design pressure for a duration of 5 minutes. Functional and sequential operation testing of the completely assembled ADP shall be demonstrated at shop. Other accessories shall be tested as per relevant code and sections. Dew point measurement shall be done.</p> <p>E.O.T. CRANE:</p> <p>a) Chain pulley Blocks shall be tested as per IS: 3832.</p> <p>b) Following NDT requirements shall be met:</p> <p>(i) 100% RT of Butt welds in tension and 10% RT of butt welds in compression.</p> <p>(ii) DP at random on all weldments.</p> <p>Deflection, load, overload & travel check on HOT crane assembly shall be carried out as per IS: 3177.</p>		
1.05.00	<p>PIPINGS, VALVES, AND FITTINGS</p> <p>a. All pipes and fittings shall be tested as per applicable code.</p> <p>b. All valves shall be hydraulically tested for body, seat and back-seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure.</p> <p>c. Valves shall be offered for hydro test in unpainted condition.</p> <p>d. Functional checks of the valves for smooth opening and closing shall also be done.</p> <p>All bar stocks/ forgings, dia \geq 40 mm shall be Ultrasonic Tested irrespective of the type, size & rating of the valve.</p>		
ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART- B	SUB-SECTION –Q-02D COMPRESSED AIR SYSTEM	Page 2 of 2

QUALITY ASSURANCE

Shop Test for EOT Cranes, Other Cranes & Hoist

1.0 Hooks

1.01 All tests including proof load test as per relevant IS/BS/DIN shall be carried out.

1.02 MPI/DPT shall be carried out after proof load test.

2.0 Steel casting

2.01 DPT on machined surface shall be carried out.

3.0 Girders, end carriage, crab, gear box and rope drum, Lifting beam

3.01 The plates of thickness 25mm and above shall be ultrasonically tested.

3.02 NDT requirements on weldments shall be as follows:

- a) Butt welds in tension :- 100% RT and 100% DPT
- b) Butt welds in compression :- 10% RT and 100% DPT
- c) Butt welds in rope drum :- 100% RT and 100% DPT
- d) Fillet welds :- random 10% DPT

4.0 Forging (wheel, gears, pinions, axle, hooks & hook trunion)

4.01 All forgings greater than or equal to 50 mm diameter or thickness shall be subjected to ultrasonic testing.

4.02 DPT/MPI shall be done after hardfacing and machining.

5.0 Wire rope shall be tested as per relevant standard.

6.0 Reduction gears shall be tested for reduction ratio, backlash & contact pattern. Gear box shall be subjected to no-load run test to check for oil leakage, temperature rise, noise and vibration.

7.0 All electric hoists shall be tested as per IS-3938, chain pulley blocks shall be tested as per IS-3832 and cranes shall be tested as per IS: 3177. Lifting Beam will be subjected to overload testing at @1.25 XSWL of Lifting Beam at manufacturer works.

QUALITY ASSURANCE

GENERATORS & AUXILIARIES (up to 20MW)

PROCESS CHECK FOR STATIC PARTS GENERATOR / EXCITOR

TESTS ITEM/ COMPONENTS /PROCESS	Visual & dimension	Chem. Prop.(raw material)	Heat treatment	Mech. Prop.(raw material as applicable)	Impact.(raw material)	RT/UT (10% for butt weld)	MP/DFT(All welds of Injuniun & base plate, samde on other)	Relative permeability	DIN 43760, IS 2848, 7358	DIN 48124
Sheet and Fabrication - Stator Frame, End Shield, Terminal Box etc.	Y	Y	Y	Y	Y	Y	Y			
Bearing	Y	Y		Y		Y1				
Terminal Bushing										Y
RTD/ Thermocouple								Y		
Non magnetic Components							Y			

PROCESS CHECK FOR CORE GENERATOR/EXCITOR

TESTS ITEM/ COMPONENTS / PROCESS	Specific loss before and after ageing	Magnetization	Anisotropy of losses	Stacking factor	Burr level	chem., elect., viscosity cure time, solid content, dielectric properties	Dimension & surface (uniformity of varnish coat)	Spot weld check	Process check including Heating & pressure application	Insulation test of insulated core tension bolt & core bar	Functional check of ventilation ducts	Hot spot at rated flux density by infra red camera & ELCID *	Location of temp. detectors	Iron loss at rated flux density
Core lamination	Y	Y	Y	Y	Y		Y							
Check for varnish						Y								
Ventilation Stamping								Y						
Core assembly							Y							
CORE assembly (additional Checks for Generator)								Y	Y	Y	Y	Y	Y	

Y-Test applicable

*** In case of any constraint of manufacturer to carry out the test at rated flux , testing at reduced flux as per manufacturer guidelines to be proposed to Owner for review & approval**

QUALITY ASSURANCE

GENERATORS & AUXILIARIES

PROCESS CHECK FOR STATOR CONDUCTOR AND WINDING (GENERATOR/ EXCITOR)

TESTS ITEM/ COMPO-NENTS /PROCESS	Mech. prop (sample)	Chem. prop (sample)	Resistivity/Resistance	Insulation adhesion	Flexibility of bending	Dielectric test	Dimension/visual	Electric test	Physical prop.	Brazing procedure	Process check	Check on RTD + location winding	Tan delta and delta, tan delta Up to 1.2 un	Corona protection resistance	Reactance of stator winding	Dielectric test at elevated And room temp.	Inter strand Insulation test	Slot wedge tightness & radial movement	Support arrangement
Winding copper	Y	Y	Y																
Insulated conductor				Y	Y	Y	Y												
Insulation material	Y	Y					Y	Y	Y										
Manufacturing Winding bar/coil & phase bar						Y	Y	Y		Y	Y								
Winding laying						Y	Y	Y			Y	Y							
Winding support ring		Y					Y		Y										
Insulated conductor																Y			
Manufacturing Winding bar/coil & phase bar													Y	Y			Y		
Winding laying																			Y
wound stator													Y		Y			Y	

Y-Test applicable, Y1-UT on Babbitt for bearing.

Note:

- 1- This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. All generators shall be assembled at works and shall be tested to verify/ensure design and workmanship in accordance with IEC-34, VDE 0530, IEEE 115, IEEE 43. The manufacturer shall submit detailed test procedure which clearly specify test set up, instruments to be used, acceptance norms (wherever applicable) recording of different parameter, interval of recording, precautions etc.
3. Cooler, control panel and other auxiliaries (as applicable) to be suitably tested as per tests covered in the specification.

QUALITY ASSURANCE

**GENERATORS & AUXILIARIES
PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)**

ITEM/ COMPONENTS / PROCESS	TESTS										
	Rep. sample tensile stress	Rep. sample 0.2 limit	Rep. sample elongation	Hardness on Sample	Impact check on sample	Rep. sample Chem. prop.	NDTT, FATT (as applicable)	Process check including heat treatment (as applicable)	Ultrasonic test/RT (at suppliers works and after preliminary machining)	Flux carrying capacity / Magnetic prop *	Boroscopic Examination
Rotor forging & slip ring shaft	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rotor end retaining ring, locking ring & Slip ring forgings, diode wheel	Y	Y	Y		Y	Y		Y	Y		
Rotor wedges, damper Wedges.	Y		Y			Y		Y	Y		
Rotor winding copper CC-bolts & D-leads	Y		Y			Y		Y			
Rotor slot boxes/ insulating material						Y					
Rotor winding											
Complete rotor								Y			
Test on completed rotor at various speed up to rated speed											
Test on completed rotor before & after over speed											
Fan hubs/blades						Y		Y	Y		
GENERATOR assembly											
Diode wheel Assembly											
Permanent magnet					Y					Y	
EXCITER assembly											

Y- Test Applicable

* Not applicable for slip ring shaft of SEE

QUALITY ASSURANCE

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

ITEM/ COMPONENTS /PROCESS	TESTS								
	MPI/DP/NDT test	Visual/Dimension/Cleanliness	Adhesion, thickness of Coat on silver plating If applicable	Electrical conductivity and Oxygen content	Mech. test on sample	Electrical test (Σ)	Resistance measurement	Inter turn test	Dielectric test
Rotor forging & slip ring shaft	Y	Y							
Rotor end retaining ring & cover, locking ring & Slip ring forgings, diode wheel	Y		Y						
Rotor winding copper, rotor wedges, damper Wedges, CC-bolts & D-leads	Y		Y	Y1		Y			
Rotor slot boxes/ insulating material					Y	Y			
Coil manufacture		Y							
Rotor winding		Y				Y		Y	Y
Complete rotor							Y		Y
Test on completed rotor at various speed up to rated speed								Y	Y
Test on completed rotor before & after overspeed		Y					Y	Y	Y
Fan hubs/blades	Y	Y							
GENERATOR assembly		Y							
Diode wheel Assembly		Y							
Permanent magnet		Y			Y				
EXCITOR assembly		Y							

Y-Test Applicable , Y1: Oxygen content applicable for Rotor winding copper & D Lead,
 Σ NOTE- Dielectric test & conductivity test etc. as applicable

QUALITY ASSURANCE

GENERATORS & AUXILIARIES

PROCESS CHECK FOR ROTOR AND ASSEMBLY (GENERATOR/EXCITOR)

ITEM/ COMPONENTS /PROCESS	TESTS									
	Insulation Resistance	PI	Radial run out/alignment	Impedance measurement/ RSO (repetitive surge oscillograph)	Dynamic balancing ISO 5406, 2372, 1940	Over speed test (120%) for 2 minute	Axial run out	Metallography examination	Torque on joint bolts	Fitting and locking of Balancing weights	Brazer and brazing procedure
Rotor forging & slip ring shaft								Y		
CC-bolts									Y	
Coil manufacture										Y
Rotor winding										Y
Complete rotor	Y		Y	Y	Y	Y		Y		
Test on completed rotor at various speed up to rated speed				Y						
Test on completed rotor before & after overspeed	Y		Y	Y						
Fan hubs/blades									Y	
GENERATOR assembly	Y	Y	Y				Y	Y	Y	Y
Diode wheel Assembly			Y				Y	Y	Y	
Permanent magnet										
EXCITOR assembly			Y					Y	Y	

Y-Test applicable

QUALITY ASSURANCE

**GENERATORS & AUXILIARIES
ADDITIONAL CHECK FOR EXCITOR**

ITEM/ COMPONENTS /PROCESS	TESTS									
	Routine Test as per applicable std	As per IEC-76 / Applicable std	Pole parallelism & polarity	Mech. , Chem. & Magnetic prop.(as applicable)	Functional check	Insulation resistance	IEEE/ANSI-C37.18 Or IEC 60947-2	As per applicable standards	As per specification	Dimensional and visual
Fuse diode & filter Circuit	Y									Y
Aux. Transformer (if applicable)		Y								
Carbon brush holder & housing				Y	Y				Y	Y
Cable									Y	
PMG & Exciter stator			Y	Y		Y				
Bandaging wire				Y						
Field discharge resistor					Y					
Bearing, exciter armature field, axis coil , RTD						Y				
Excitation Transformer		Y								
Thyristors									Y	
Field breaker					Y		Y			
Bus duct AC/DC								Y		
Voltage Regulator									Y	
Carbon brush				Y	Y				Y	Y

ITEM/ COMPONENTS /PROCESS	TESTS									
	Resistance measurement	Rotor impedance at various speeds	Heat run test	Function check	Voltage regulation	OCC	SCC	Record Aux. parameters	Steady state reactance' s	Efficiency By separation of losses
Works running test on generator	Y	Y	Y			Y	Y	Y	Y	Y
Without Excitation, Open Circuit & Short Circuit with rated voltage & current for Generator			Y							
Works test on brush less exciter	Y		Y			Y				
PMG works test	Y		Y		Y	Y				
Full load for PMG & convertor assembly			Y							
Convertor assembly for SEE				Y						
Static excitation system				Y						

Y - Test applicable

QUALITY ASSURANCE

ITEM/ COMPONENTS /PROCESS	TESTS									
	Insulation resistance	Polarisation index	Phase seq. voltage balance	Shaft voltage	H.V. test (except electronic circuit)	RTD, BTD Check	Capacitance measurement	Tan delta, delta tan delta	Rotor journal	Bearing oil catcher
Works running on generator	Y	Y	Y	Y	Y	Y	Y	Y		
On total wdg / phases at interval 0.2 Un for Generator							Y	Y		
Condition after dismantling									Y	Y
Works test on brush less exciter	Y				Y					
PMG works test	Y		Y		Y					
converter assembly for SEE	Y				Y					
Static excitation system	Y				Y					

Y - Test Applicable

GENERATORS & AUXILIARIES

FINAL ACCEPTANCE TEST GENERATOR/EXCITOR

ITEM/ COMPONENTS /PROCESS	TESTS									
	Seal rings, liners	Winding Overhang	Vibration measurement	No load	Load characteristics	Characteristics of search coil, quad, axis	Ripple content	As per specification	Visual & dimension	Partial discharge
Works running test on generator			Y						Y	Y
Condition after dismantling	Y	Y								
Works test on brushless exciter			Y	Y	Y	Y			Y	
PMG works test				Y	Y					
Static excitation system							Y	Y	Y	

Y - Test Applicable

QUALITY ASSURANCE

QUALITY ASSURANCE & INSPECTION														
GENERATOR BUS DUCT & NG EQUIPMENT														
Attributes / Characteristics	Visual & Dimensional Checks	Electrical / Mechanical / Chemical Properties	WPS & PQR	NDT / DP / MPI / UT	Painting Quality & Adhesion Test	Galvanising Test as per IS: 2629 / 2633 / IS: 6745	Electrical clearance & Creepage	Functional/Operational check	Make / Type Rating / Model / TC / General Physical Inspection	Trial Assembly at works.	Routine Test as per relevant standard	Test as per IEEE-32 for NGR	IR Measurement before and after HV Test for NGR	
Items/Components Sub Systems														
Enclosure / Cubicle	Y	Y		Y	Y									
Bus bar Conductor/Flexible Connector & Dis-connector Link	Y	Y												
Enclosure Sheet	Y	Y												
Epoxy Sealoff Bushing, Post/Support Epoxy/Porcelain Insulator as per IS:5621 & 2544														
Galvanised Steel Structure & Plate	Y					Y								
Welding on Enclosure & Conductor joint	Y		Y	Y										
Gasket, Silica gel Breather, CT, VT, Surge Capacitor & Arrestor, NGT, NGR, Elastomer Spring Head, Panel Mounted Items & NG Cubicle	Y							Y	Y		Y	Y	Y	
Bus Bar Pressurisation System	Y							Y						
Complete Bus Duct & Cubicles	Y				Y					Y	Y			
Complete NGR (IEEE-32)	Y				Y			Y			Y			
<p>Note:</p> <ol style="list-style-type: none"> 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents during QP finalization for all the items. 2. All major Bought Out Items will be subject to NTPC approval. 														

QUALITY ASSURANCE

OIL FILLED TRANSFORMER

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test	Voltage Ratio, Vector Group & Polarity, Magneto Balance Test	Make / Type / Rating / Model / TC / General Physical Inspection	Functional check	WPS & PQR	Routine Test as per relevant standard / NTPC Specification
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Y					Y	
Conservator / Radiator / Cooler / Pipes	Y	Y					Y						
Copper Conductor (IS:191)	Y	Y	Y		Y								
Insulating Material	Y	Y	Y	Y	Y	Y							
CRGO Lamination & Built Core	Y	Y	Y		Y	Y				Y			
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Y			Y
Gasket	Y	Y			Y	Y		Y		Y			Y
Transformer Oil (IEC296)			Y										Y
OLTC / Off-Circuit Tap Changer	Y									Y			Y
Core Coil Assembly & Pre-tanking	Y								Y	Y			
Marshalling Box	Y									Y	Y		Y
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Valves	Y									Y	Y		
Welding (ASME Sect-IX)	Y						Y					Y	
Complete Transformer (IS:2026 / IEC-60076)	Y												Y

DRY TYPE TRANSFORMER

Attributes / Characteristics Items/Components Sub Systems	Visual & Dimensional check	Mechanical properties	Electrical strength	Thermal Properties	Chemical Properties	NDT / DP / MPI	Voltage Ratio, Vector Group & Polarity	Make / Type / Rating / Model / TC / General Physical Inspection	Routine Test as per relevant standard / NTPC Specification
Enclosure door, H.V. & L.V. Cable Box / Flange Throat	Y	Y						Y	
Copper Conductor	Y	Y	Y		Y				
Insulating Material	Y			Y		Y			
CRGO Lamination & Built Core	Y							Y	
Porcelain Bushing / Insulator (IS:2544 / 5621)	Y	Y	Y					Y	Y
Gasket (IS 2712)	Y	Y						Y	Y
Off-Circuit Tap Changer	Y							Y	Y
Core Coil Assembly	Y						Y		
Marshalling Box	Y								Y
WTI, Thermistor, Terminal Connector	Y							Y	
Complete Transformer (IS:11171 / IEC 60076)	Y								Y

Note: 1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2) All major Bought Out items will be subject to NTPC approval.

QUALITY ASSURANCE

QUALITY ASSURANCE & INSPECTION MODULE NO. SQE-16													
CABLING, EARTHING, LIGHTNING PROTECTION													
ATTRIBUTES / CHARACTERISTICS	Dimension												
ITEMS/COMPONENTS / SUB SYSTEMS			IP protection	Proof load*	Surface finish		HV & IR	Galvanise Test (If Applicable)	Functional		Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NVVN
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y		Y		Y		Y		Y		Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y		Y		Y		Y	Y	Y		Y	Y	Y
Lighting wire (IS-694)	Y										Y		
Flexible conduits	Y										Y		Y
Conduits (Galvanise & Epoxy) IS-9537 & IS-2629, 2633, 6745	Y							Y			Y		Y
Cable termination & straight through joint (IS 13573)	Y										Y		Y
Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y			Y	Y			Y			Y	Y	Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y							Y			Y		Y
Fire Sealing System (BS -476)											Y	Y	Y
<p>.Note: 1. This is an indicative list of tests /checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.</p> <p>2.* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NVVN technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses.</p> <p>3. Make of all items will be subject to NVVN approval.</p>													

QUALITY ASSURANCE

Control Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Spark Test(as applicable)	Electrical properties	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Routine & Acceptance Tests as per relevant standard & NVVN specification	FRLS Tests
Copper (IS-8130)	Y	Y	Y		Y					
PVC insulation Compound (IS: 5831)	Y		Y		Y		Y	Y		
Extrusion & curing /Manufacturing of Core		Y		Y				Y		
Armour wire/strip	Y	Y	Y							
Inner sheath	Y	Y								
Armouring		Y								
Finished Cable (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)						Y	Y	Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y								

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NVVN approval.

QUALITY ASSURANCE

ROUTINE TESTS	Following routine tests shall be carried out on each drum of finished cables for all sizes.	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	Following Acceptance tests shall be carried out on each size of cables, in the offered lot.	
A) For Conductor (as per sampling plan mentioned in IS: 1554)		
	1)	Annealing test (Copper)
	2)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
C) For PVC insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")

QUALITY ASSURANCE

D) Ageing test:				
	Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine. The values will be compared with corresponding values mentioned in the Type Test report accepted by NVVN. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
E) Following tests will be carried out on completed cables as per IS on each size:				
	1)	Insulation resistance test (Volume resistivity method)		
	2)	High voltage test		
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes):				
	1)	Thermal stability test on PVC insulation and outer sheath		
	2)	Oxygen index test on outer sheath		
	3)	Smoke density rating test on outer sheath		
	4)	Acid gas generation test on outer sheath		
G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cable will be carried out as per following sampling plan:				
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured, unarmoured) will be bunched together, as per calculations in line with the IEC. All sizes of armoured & unarmoured cables shall be covered.		
H) Following tests shall be carried on one length of each size (armoured & unarmoured) of offered lot:				
	1)	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / outer sheath extrusion's batch number marking		
	2)	Measurement of Eccentricity & Ovality		

QUALITY ASSURANCE

DC SYSTEM SQE_19 Battery

ATTRIBUTES / CHARACTERISTICS →						
ITEMS, COMPONENTS, SUB SYSTEM ASSEMBLY ↓	Dimensions & Finish	Conformance to relevant part drg. & Manufacturer's standards	Lead Coating Thickness (min. 25 microns, IS: 6848 App.F) & Adhesion Check	Conformance to CPWD Spec. for Teak Wood	Constructional requirements as per NVVN Spec.	Routine & acceptance tests as per relevant standard
Container & Lids (IS : 1146)	Y	Y				
Vent Plugs	Y	Y				
Sealing Compound (IS : 3116)		Y				
Positive & Negative Plates		Y				
Separators (IS : 6071)	Y	Y				
Inter-cell Connectors & Fasteners	Y	Y	Y			
Cell Insulators	Y	Y				
Stack Assembly	Y	Y				
Lead Acid Battery (IS : 1652)	Y				Y	Y

Note: This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

QUALITY ASSURANCE

ATTRIBUTES / CHARACTERISTICS					
	ITEMS, ASSEMBLY	COMPONENTS,	SUB	SYSTEM	
					Dimensions & Finish
					Conformance to relevant Manufacturer's standards
					Resistance to Alkali
					Nickel Plating thickness
					Routine & acceptance tests as per relevant standard
Container & Lids	Y	Y	Y	Y	
Vent Plugs	Y	Y	Y	Y	
Perforated Steel Strips	Y	Y	Y	Y	Y
Separators	Y	Y	Y	Y	
Inter-cell Connectors & Fasteners	Y	Y	Y	Y	Y
Battery Stand	Y			Y	
Cell Insulators	Y	Y		Y	
Stack Assembly	Y	Y			
Ni-Cd Battery (IS : 10918)	Y				Y

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Makes of all major Bought Out Items will be subject to NVVN approval.

QUALITY ASSURANCE

BATTERY CHARGER												
Attributes / Characteristics →	Items / Components / Sub- assembly ↓	Make, Model, Type, Rating & Finish	Sheet Steel Pretreatment & Painting process	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per NVVN approved drgs &	Temperature Rise Test	Ripple Content Test, Load Limiter & AVR Operation Test	Operational & Functional Checks	HV & IR Test	Burn-In Test at 50°C for 48 hrs in energised condition	Alternating current measurement test	
Rectifier Transformer and Reactors (IS : 4540, 2026)	Y					Y			Y			
Electronic Components including Potentiometer (Vernier Type)	Y				Y							
Electronic Cards	Y								Y			
PCB & racks for electronic cards	Y				Y							
Control & Selector Switches (IS : 6875)	Y							Y				
Indicating Meters (IS : 1248)	Y							Y				
Indicating Lamps (IS: 13947)	Y							Y				
Air Break Switches / Fuses (IS : 13947 / 13703)	Y							Y				
Control Transformer (IS : 12021)	Y							Y				
MCB (IS : 8828)	Y							Y				
PVC insulated Copper control wires (IS : 694)	Y											
Sheet Steel (IS : 513)	Y		Y									
Synthetic Rubber Gaskets	Y											
Annunciator	Y							Y	Y			
Battery Charger	Y			Y	Y	Y	Y	Y	Y	Y	Y	
Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NVVN approval.												

QUALITY ASSURANCE

BATTERY CHARGER (of capacity upto 24 V / 48 V , 150 A DC)										
Attributes / Characteristics →	Make, Model, Type, Rating	Dimensional check and Paint shade, thickness, adhesion & Finish checks	Complete physical examination for constructional features as per approved drgs	Ripple Content Test, Load Limiter operation & AVR Operation Test	Operational & Functional Checks of aux. Devices like annunciator, switches, inductors etc.	HV & IR Test	Burn-In Test	Dynamic response test	AC input current measurement test	Temperature rise test
Items / Components / Sub- assembly ↓										
Battery Charger	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<p>Note</p> <ol style="list-style-type: none"> This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. Makes of all major Bought Out Items will be subject to NVVN approval. 										

QUALITY ASSURANCE

DC HEALTH MONITORING SYSTEM										
Attributes / Characteristics →	Make, Model, Type, Rating & Finish				Conform to relevant Standard & NVVN spec	Dimensional check and Paint shade, thickness, adhesion & Finish checks		Operational & Functional Checks	HV & IR Test	Degree of Protection Test as per NTCP Spec.
Enclosure	Y				Y	Y				Y
Synthetic Rubber Gaskets	Y				Y					
Control Terminal Blocks ,Push Buttons, MCB	Y				Y			Y		
MCB	Y				Y			Y		
PVC insulated Copper control / signal cables	Y				Y					
Transducers / detectors	Y				Y			Y		
PCB & racks for electronic cards	Y									
Microprocessor Based Controller	Y							Y		
SCADA	Y							Y		
DC Health Monitoring System	Y				Y	Y		Y	Y	Y
Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NVVN approval.										

QUALITY ASSURANCE

DIESEL GENRATOR SET

SQE_18

DIESEL ENGINE

TESTS/CHECKS ITEMS/COMPONENTS	Material Test	DP/MPI	UT(On forging and piston Bonding)	Balancing	Hydraulic/water fill test	Assy./fit up	Dimension	Functional/Operation test	Performance test as per BS-5514/or equivalent IS/ISO-Standard including Governing Test for 3 hrs at full load and one hr at 10% overload	Fuel consumption, rated power measurement, rated speed	All other tests(if applicable) as per Spec./ relevant standard
Crank shaft	Y	Y	Y	Y							
Cylinder blocks/heads	Y				Y						
Liner/ Radiator	Y				Y						
Rotating/moving parts other than crank shaft	Y	Y									
Piston	Y	Y	Y								
Diesel Engine						Y	Y	Y	Y	Y	Y
<p>Note: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents in line in case required as per agreement with NVVN.</p> <p>2. Make of all major BOIs will be subject to NVVN approval.</p>											

QUALITY ASSURANCE

ALTERNATOR																		
TESTS/CHECKS																		
ITEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All tests as per IS--4722	Vibration	Over speed	Tan delta, shaft voltage & polarisation index test
Plates for stator frame,end shield, spider etc.	Y	Y	Y	Y					Y									
Shaft	Y	Y	Y	Y	Y	Y			Y									
Magnetic Material	Y	Y	Y	Y	Y		Y			Y		Y						
Rotor Copper/Aluminium	Y	Y	Y	Y		Y	Y		Y			Y						
Stator copper	Y	Y	Y	Y			Y		Y			Y						
SC Ring	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y						
Insulating Material	Y		Y	Y			Y					Y						
Tubes for Cooler	Y	Y	Y	Y	Y				Y		Y							
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y							
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y										
Castings, stator frame,terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y										
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y				Y									

QUALITY ASSURANCE

ALTERNATOR																		
TESTS/CHECKS	Visual	Dimensional	Make/Type/Rating/TC/General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	All Routine tests as per IS-4722	Vibration	Over speed	Tan delta, shaft voltage & polarisation index test
ITEMS/COMPONENTS																		
Wound stator	Y	Y					Y	Y										
Wound Exciter	Y	Y					Y	Y										
Rotor complete	Y	Y					Y						Y	Y				
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y											
Accessories, RTD, BTD,CT,AVR. Brushes, Diodes,Space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y															
Alternator (IS 4722)	Y	Y	Y												Y	Y	Y	Y1
Note: 1 This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and Procedure along with relevant supporting documents during QP finalisation. 2. Make of all major BOIs will be subject to NVVN approval. Y1= for HT Machines only.																		

QUALITY ASSURANCE

FINAL ASSEMBLY										
TESTS/CHECKS										
ITEMS/COMPONENTS	Material Test	Dimension	WPS/PQR/Welding	NDT/DP/MPI/UT	Check completeness	Hydraulic/Leak/Pressure test	Functional Tests	All routine test as per Spec/ IS	No load test for 5 min & partial load for one hour of the DG set assembly	Clearances & Alignment
Base frame	Y	Y	Y	Y	Y					
Fuel Tank	Y	Y	Y	Y	Y	Y				
Battery								Y		
Battery Charger								Y		
Control Panel								Y		
Assembled DG Set		Y			Y		Y		Y	Y
<p>NOTES:</p> <ol style="list-style-type: none"> This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during finalisation of QP. Make of all major Bought Out Items will be subject to NVVN approval. 										

QUALITY ASSURANCE

MOTOR

TESTS/CHECKS TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Electrical Characteristics	Welding/Brazing(WPS/PQR)
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y		
Shaft	Y	Y	Y	Y	Y		
Magnetic Material	Y	Y	Y	Y		Y	
Rotor Copper/Aluminium	Y	Y	Y	Y		Y	
Stator copper	Y	Y	Y	Y		Y	
SC Ring	Y	Y	Y	Y	Y	Y	Y
Insulating Material	Y		Y	Y		Y	
Tubes, for Cooler	Y	Y	Y	Y	Y		
Stator/Rotor, Exciter Coils	Y	Y	Y			Y	Y
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y		Y
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y		Y
Wound stator	Y	Y				Y	Y
Wound Exciter	Y	Y				Y	Y
Rotor complete	Y	Y				Y	
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y				Y	
Complete Motor	Y	Y	Y				

QUALITY ASSURANCE

ITEMS/COMPONENTS	TESTS/CHECKS							
	Magnetic Characteristics	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS-9283/IS 2148/IEC60034/IEC 60021	Vibration	Over speed	Tan delta, shaft voltage & polarization index test
Plates for stator frame, end shield, spider etc.								
Shaft								
Magnetic Material	Y	Y						
Rotor Copper/Aluminium								
Stator copper		Y						
SC Ring								
Insulating Material		Y						
Tubes for Cooler								
Stator/Rotor, Exciter Coils								
Fabrication & machining of stator, rotor, terminal box								
Wound Exciter								
Rotor complete			Y	Y				
Accessories, RTD, BTD, CT, , Space heater, antifriction bearing, gaskets etc.								
Complete Motor					Y	Y	Y	Y1

QUALITY ASSURANCE

QA Table for Cathodic Protection

Attributes /Characteristics Items, Components, Sub-System Assembly	Make, type, model, rating & TC	Visual Check	Electrical Properties	Mechanical Properties	Chemical Properties	Dimension and Finish	Functional & Operational Feature	Painting as per tech specs.	All Routine and Acceptance tests as per relevant standards/tech Specs
TR unit	Y	Y	Y			Y	Y	Y	Y
Silicon Chromium Anode	Y	Y		Y	Y	Y		Y	
Junction Box	Y	Y	Y			Y		Y	Y
Permanent Reference Cell(Cu-CuSO4)	Y	Y				Y			
Sacrificial Magnesium Anode	Y	Y		Y	Y	Y		Y	Y
Zinc Anode	Y	Y		Y	Y	Y		Y	Y
MMO Anode	Y	Y	Y	Y	Y	Y	Y	Y	Y
Surge Diverter	Y	Y	Y		Y	Y			Y
ER Probe and Reader	Y	Y				Y			Y
Polarization Cell	Y	Y	Y		Y	Y			Y
Cables	Y	Y	Y	Y		Y			Y
Test Station	Y	Y						Y	Y

NOTE:

1. This is an indicative list of tests/ checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant and supporting documents.
2. Make of all Bought Out Items will be subject to NVVN approval

QUALITY ASSURANCE

		STATION LIGHTING				SQE_17					
Item Components Sub System Assembly	Attributes Characteristics	Make, Type , Rating/ TC	Dimension	Galvanization Tests	IP Test	Bought Out Items/ Bill of Material	HV & IR	Functional Check as per spec.	Routine Test as per relevant std and spec	Acceptance Test as per relevant std and spec	
		Luminaries (IS-10322 Part-5 Sec.1 (non -LED type)	Y				Y		Y		Y	Y
Lighting Wire (IS-694)	Y								Y		
Fans (IS-374)	Y								Y		
Pole (IS-2713)	Y								Y	Y	
Lamps (IS-9800, IS-9974)	Y								Y	Y	
Lighting Mast (with raise & lower lantern type)	Y	Y		Y					Y	Y	
Wall Mounted Lighting Panel (IS-513, IS-5)	Y	Y		Y	Y	Y	Y	Y	Y	Y	
Switch Box/ Junction Box/Receptacles/ Local Push Button Station / Lighting Panel (IS-513, 2629, 2633, 4759, 6745)	Y	Y		Y	Y	Y	Y	Y	Y	Y	
Lighting Transformer (IS-11171)	Y								Y		
Epoxy & Galvanised Conduit (IS-9537, 2629, 2633, 4759, 6745)	Y	Y							Y		
<p>Notes:</p> <ol style="list-style-type: none"> This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. Make of all major Bought Out Items will be subject to NVVN approval. 											

QUALITY ASSURANCE

MV (3.3 kV / 6.6. kV / 11 kV / 33 kV) Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity &	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability on outer sheath	Constructional requirements feature as per NVVN specification	Routine & Acceptance Test as per relevant standard & NVVN specification	FRLS Test
Aluminum (IS-8130)	Y	Y	Y	Y		Y							
Semiconducting Compound	Y		Y			Y							
XLPE Compound (IS-7098 Part-II)	Y		Y			Y			Y				
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58) ,IEC-60754 Part-1)	Y		Y						Y	Y			Y
Triple Extrusion & curing /Manufacturing of Core		Y			Y		Y						
Copper Tape	Y	Y	Y			Y							
Polyster tape	Y	Y											
Armour wire/strip	Y	Y	Y										
Copper tapping	Y	Y											
Inner sheath	Y	Y											
Armouring		Y											
Outer Sheathing		Y						Y					
Power Cable (Finished)								Y	Y	Y	Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y									Y		

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NVVN approval.

QUALITY ASSURANCE

LT Power Cables

Attributes / Characteristics Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NVVN specification	Routine & Acceptance Tests as per relevant standard & NVVN specification	FRLS Tests
Aluminum (IS-8130)	Y	Y	Y	Y		Y										
XLPE Compound (IS-7098)	Y		Y			Y	Y				Y					
PVC insulation Compound (IS: 5831)	Y		Y			Y					Y	Y				
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y								Y	Y				Y
Extrusion & curing /Manufacturing of Core (PVC / XLPE)		Y			Y	Y						Y				
Core Laying								Y								
Armour wire/strip	Y	Y	Y													
Inner sheath	Y	Y														
Armouring		Y							Y							
Outer Sheathing		Y								Y						
Power Cable (Finished) (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)								Y	Y	Y	Y	Y		Y	Y	Y
Wooden drum(IS-10418) /Steel Drum		Y											Y	Y		

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought out items will be subject to NVVN approval.

QUALITY ASSURANCE

ROUTINE TESTS	Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.	
1)	Conductor Resistance test	
2)	High voltage test	
ACCEPTANCE TESTS	Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.	
A) For Conductor (as per sampling plan mentioned in IS: 1554 / 7098)		
	1)	Annealing test (Copper)
	2)	Tensile Test (Aluminum)
	3)	Wrapping Test (Aluminum)
	4)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554 / 7098)		
	1.	Measurement of Dimensions
	2.	Tensile Tests
	3.	Elongation Test
	4.	Torsion Test For Round wires only
	5.	Wrapping Test
	6.	Resistance Test
	7.	Mass of Zinc coating test For G S wires / Formed wires only
	8.	Uniformity of Zinc coating For G S wires / Formed wires only
	9.	Adhesion test For G S wires / Formed wires only
	10.	Freedom from surface defects
C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)		
	1)	Test for thickness
	2)	Tensile strength & Elongation before ageing (for tests after ageing see "D")
	3)	Hot set test (For XLPE insulation)

QUALITY ASSURANCE

D) Ageing test:				
	Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine. The values will be compared with corresponding values mentioned in the Type Test report accepted by NVVN. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
		Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
XLPE insulation	Samples as per relevant IS, from each size of cables in the offered lot, will be put on ageing test as per IS.			
E) Following tests will be carried out on completed cables as per IS on each size of each type (PVC / XLPE insulated)				
		Insulation resistance test (Volume resistivity method)		
		High voltage test		
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)				
		Thermal stability test on PVC insulation and outer sheath		
		Oxygen index test on outer sheath		
		Smoke density rating test on outer sheath		
		Acid gas generation test on outer sheath		
G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cables as per following sampling plan:				
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered.		

QUALITY ASSURANCE

	For one particular type, cables with OD less than or equal to 30 mm shall be clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per NVVN approved datasheet.
H) Following tests shall be carried on one length of each size of each type (PVC / XLPE insulated) of offered lot:	
	Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / Batch (outer sheath extrusion batch)number marking on sheath
	Measurement of Eccentricity & Ovality

QUALITY ASSURANCE

QA Table for HT SWITCHGEAR

ATTRIBUTES / CHARACTERISTICS →	Make, Type, Model, Rating & TC	Electrical Properties	Mechanical properties	Dimensions & Finish	Functional & Operational Features as per NVVN Spec.	Item to conform to relevant Standards	Functional Checks	HV & IR Test	Degree of Protection Routine test as per NVVN spec.	All Routine Tests as per relevant
ITEMS, COMPONENTS, SUB-SYSTEM ASSEMBLY ↓										
Aluminum Bus bar material (IS : 5082)	Y	Y	Y	Y		Y				
Copper Bus bar material (IS : 613)	Y	Y	Y	Y		Y				
Bus bar Support Insulator	Y	Y	Y	Y		Y		Y		
HT Circuit Breaker (IEC-62271-100)	Y			Y	Y	Y	Y			Y
HT Contactors (IS : 9046 / IEC 60470)	Y			Y	Y	Y	Y			Y
Protection & Auxilliary Relays	Y			Y	Y	Y	Y			Y
HT CT's & PT's (IS : 2705 / 3156)	Y			Y		Y				Y
Surge Arrester (IEC : 99 -4)	Y			Y		Y				Y
LT Contactors (IS : 13947)	Y			Y	Y	Y	Y			
Control & Selector Switches (IS : 6875)	Y			Y	Y	Y	Y			
Control Transformer (IS : 12021)	Y			Y	Y	Y	Y			Y
Energy Meters (IS : 722)	Y			Y	Y	Y	Y			Y
Transducers (IEC : 60688)	Y			Y	Y	Y	Y			Y
Breaker Handling Trolley	Y			Y	Y		Y			
HT Switchgear Panel (IEC-62271-200)	Y			Y	Y	Y	Y	Y	Y	Y

Notes:

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Make of all major Bought Out Items will be subject to NVVN approval.

QUALITY ASSURANCE

SQE 10

LT SWITCHGEAR												
(MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)												
ATTRIBUTES / CHARACTERISTICS	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NVVN Spec.	Pretreatment as per IS 6005	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NVVN spec	All Routine tests as per NVVN
ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY												
Sheet Steel (IS : 513)	Y	Y		Y	Y							
Aluminum Bus bar Material (IS : 5082)	Y	Y	Y	Y	Y							
Copper Bus bar Material (IS : 613)	Y	Y	Y	Y	Y							
Air Circuit Breaker (IS: 13947)	Y	Y				Y		Y	Y			Y
Energy Meters (IS : 13010, 13779)	Y	Y				Y		Y				Y
Power & Aux. Contactors (IS : 13947)	Y	Y				Y		Y				
Protection & Aux. Relays (IS : 3231) (IEC 60255 / IEC 61850)	Y	Y				Y		Y				Y
CT's & PT's (IS 2705 / 3156)	Y	Y										Y
Air Break Switches (IS : 13947)	Y	Y				Y		Y				

QUALITY ASSURANCE

LT SWITCHGEAR														
(MCC, PCC, ACDB, DCDB, FUSE BOARDS, LOCAL PUSH BUTTON STATION, LOCAL MOTOR STARTERS)														
ATTRIBUTES / CHARACTERISTICS →														
ITEMS/ COMPONENTS/ SUB SYSTEM ASSEMBLY ↓	Make, Model, Type, Rating & TC	Dimensions & Finish	Electrical properties	Mechanical Properties	Chemical properties	Functional & Operational Features as per NVVN Spec.	Item to conform to relevant Standards	Pretreatment as per IS 6005	Paint Shade, Adhesion, Thickness & Finish	Functional Checks	Milli-volt drop Test	IR – HV – IR Test	Degree of Protection Routine test as per NVVN spec	All Routine tests as per NVVN spec. & IS
Control Transformer (IS : 12021)	Y	Y				Y	Y			Y				Y
Push Buttons (IS : 4794)	Y	Y				Y	Y			Y				
Transducer (IEC : 60688)	Y	Y				Y	Y			Y				Y
Breaker Handling Trolley	Y	Y				Y			Y	Y				Y
LT SWITCHGEAR (IS : 8623)	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y
Notes:														
1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Makes of all major Bought Out Items will be subject to NVVN approval.														

QUALITY ASSURANCE

LT BUSDUCT														
ATTRIBUTES, CHARACTERISTICS →	ITEM, COMPONENTS, SUB SYSTEM ASSEMBLY	Dimension & Surface Finish	Make, Type, Rating & TC	Electrical Properties	Mechanical Properties	Chemical Properties	WPS Approval, Welder Qualification	Weld Quality Check (DP test & x-ray				Galvanizing Test as per IS 2629/ 2633/ IR – HV – IR Test	Phase Sequence Check	Degree of Protection routine test as per NVVN spec.
	Aluminum Sheets / Plates / Strips / Flexibles / tubes (IS : 5082 / 737)	Y	Y		Y	Y	Y	Y						
	CRCA Flats / ISMC (IS 2062)	Y	Y		Y	Y								
	Neoprene / Synthetic Rubber Gaskets (IS 11149 / 3400)	Y	Y		Y	Y								
	Rubber Bellows (IS : 3400)	Y	Y		Y	Y								
	Support Insulator (BS : 2782, IEC : 660, IS : 10912)	Y	Y	Y	Y									
	Galvanized Structure & GI Earthing Flat (IS : 2629 / 2633 / 4749)	Y	Y								Y			
	Space Heater & Thermostat		Y	Y								Y		
	LT Busduct (IS : 8623 PART 2)	Y	Y				Y	Y			Y	Y	Y	
Notes:														

1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
2. Makes of all major Bought Out Items will be subject to NVVN approval.

QUALITY ASSURANCE

VFD PANEL

Attributes Characteristics	Item Components Sub System Assembly	Electrical Properties	Mechanical Properties	Chemical Properties	Dimensions / Finish	Type/ Rating/Functional check	HV/IR	Routine test as per relevant std.	Constructional Features	IS:6005 .Seven tank process	Paint finish/ shade/thickness	Mountings / BOM/ Make, Completeness / Wiring	Interlock Functional & Operation Testing / Simulation check	Degree of Protection Test	Final testing as per Relevant IS/IEC
	Sheet Steel (IS-513)		Y	Y	Y										
	Aluminum / Copper Bus-bar (IS-5082/IS-613/IS-1987)	Y	Y	Y	Y										
	Support Insulator (BS-2782/IEC-660/IS-10912)	Y	Y	Y	Y										
	Control / Selector Switch (IS-6875)					Y	Y	Y							
	Contactors/ MCB (IS-13947)					Y	Y	Y							
	O/L Protection relays (IS-3231)					Y		Y							
	C.T /V.T/ Indicating Meter (IS-2705/3156/1248)					Y	Y	Y							
	Fuse/ Fuse carrier (IS-13703)					Y	Y	Y							
	Terminals/lugs/pvc wires (IS-13947//IS-694)	Y			Y	Y	Y	Y							
	Timers (IS-3231)					Y	Y	Y							
	Push Button/ Lamp/ (IS-6875)					Y	Y	Y							
	Control Transformer (IS-12021)					Y	Y	Y							
	Mimic, Annunciater					Y		Y							
	GASKET (IS-11149)		Y	Y	Y	Y		Y							
	Fabrication								Y						
	Pretreatment & Painting									Y	Y				
	VFD panel									Y	Y		Y	Y	Y
NOTE:															
1. This is an indicative list of Test/ Checks. The manufacturer to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.															
2. All major Bought Out Items will be subject to NVVN approval.															

QUALITY ASSURANCE

SWITCHYARD

SQE_20

Attributes / Characteristics Items/Components Sub Systems	Make, model, Type & Rating, Test Certificate	Routine & Acceptance Test as per IS / IEC	Functional requirements as per NVVN Specification
Circuit Breaker (IEC:62271-100)	Y	Y	Y
Isolator (IEC:62271-102)	Y	Y	Y
Current Transformer (IEC:60044/BS:3938/IS2705/ IEC: 61869)	Y	Y	Y
Capacitor Voltage Transformer (IEC:186A / 358/IS3156/IEC60044/ IEC: 61869)	Y	Y	Y
Surge Arrestor (AIS) (IEC:99-4/IS:3070)	Y	Y	Y
Sub Station Automation system (IEC 61850)	Y	Y	Y
Protection Relays	Y	Y	Y
Energy meter	Y	Y	Y
Wave Trap (IEC:353 / IS:8792 / 8793)	Y	Y	Y
Bus Post Insulator (IEC:168 / 815 / IS:2544)	Y	Y	Y
Disc, Pin & String Insulator (IEC:383 / IS:731)	Y	Y	Y
Long Rod Insulator (IEC:433)	Y	Y	Y
Aluminium Tube (IS:5082 / 2673 / 2678)	Y	Y	Y
Conductor (IS:398)	Y	Y	Y
Hardware fittings for Insulator (IS:2486 / BS:3288)	Y	Y	Y
Hollow insulator (IEC:233/ IS:5621)	Y	Y	Y
Spacers, Clamps & Connector (IS:10162 / 5561/ 617)	Y	Y	Y
Galvanised Steel Structures (IS:2062/2629/4759/6745)	Y	Y	Y
Vibration Damper (IS:9708)	Y	Y	Y
Sag Compensating Spring DIN:2089/2096 IS:3195 / 7906	Y	Y	Y
Control & Relay Panel / SAS	Y	Y	Y
SF6 Gas filling & evacuating plant	Y	Y	Y
SF6 Gas Leak Detector	Y	Y	Y
Leakage Current Analyser	Y	Y	Y
Nitrogen Gas Filling Device	Y	Y	Y

QUALITY ASSURANCE

Attributes / Characteristics Items/Components Sub Systems	Make, Type Rating, and Model, Test Certificates	Routine & Acceptance Test as per relevant IS/IEC	Functional requirements as per NVVN Specification
Event Logger	Y	Y	Y
Operation Analyser	Y	Y	Y
Disturbance Recorder	Y	Y	Y
Synchronising Trolley	Y	Y	Y
Relay Test Kit	Y	Y	Y
<p>Notes : 1) This is an indicative list of test/checks. The manufacture is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents during QP finalisation for all items. 2) All major Bought Out Items will be subject to NVVN approval.</p>			

QUALITY ASSURANCE

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 1/2									
TESTS									
ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder(IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (IEC – 584 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD(IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
: Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.									

QUALITY ASSURANCE

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 2/2												
TESTS ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate(BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Analysers	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												
R-Routine Test A- Acceptance Test Y – Test applicable												
Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.												

QUALITY ASSURANCE

<i>INSTRUMENTATION CABLE</i>												
TESTS ITEMS												
Conductor Resistance ® & (A)												
High Voltage ® & (A)												
Insulation Resistance ® & (A)												
Constructional detail, dimensions (A)												
Outer-Sheathe/core marking, end sealing (A)												
Thermal Stability (A) +												
Visual, Surface finish (A) +												
Electrical Parameters ** (A) +												
Persulphate Test (A) +												
Overall/Coverage/Continuity (A)												
Swidesh chimney Test (SS-4241475) (A) ++												
FRLS Test * (A) ++												
Tensile & Elongation before & after aging (A) ++												
Vol. Resistivity. at room & Elevated Temp. (A) ++												
Spark test report review ®												
1. Instrument cable twisted and shielded												
Conductor(IS-8130)	Y			Y			Y					
Insulation(VDE-207)				Y	Y	Y	Y				Y	Y
Pairing/Twisting				Y	Y		Y					
Shielding				Y			Y		Y			
Drain wire	Y			Y			Y		Y	Y		
Inner Sheath				Y	Y	Y	Y				Y	Y
Outer Sheath				Y	Y	Y	Y				Y	Y
Over all cable	Y	Y	Y	Y	Y		Y	Y		Y		Y
Cable Drums(IS-10418)				Y			Y					
<p>Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784.</p> <p>Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items.</p> <p>Note : ® - Routine Test A - Acceptance Test Y - Test Applicable</p> <p>Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)</p> <ul style="list-style-type: none"> • * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1) • ** Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk (As applicable) <p>+ Sample size will be One No. of each size/type per lot.</p> <p>++ Sample size will be One No. sample for complete lot offered irrespective of size/type.</p>												

QUALITY ASSURANCE

POWER SUPPLY FOR C&I SYSTEMS (UPS/BATTERY/BATTERY CHARGER/ACDB/DCDB)																		
ITEMS	TESTS	Visual/dimension/rating/ Paint Adhesion/ Thickness (R)	General arrangement/BOM/make of components /Mimic ®	Efficiency .regulation(R)	Input voltage variation (A)	Out put voltage and frequency adi. range(A)	Preliminary light load test(R)	Load transfer retransfer test (R) *	AC input failure and return test (R)	Parallel operation and current division(R)	Relative harmonic content(R)	Restart with PRI A.C and battery (separately)(R)	System transfer and retransfer (R)*	Asynchronous transfer(R)	Ripple content(R)	Load limiter operation (R)	IR/HV(R)	Tests as per standard & specification (R)&(A)
		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
UPS/CONVERTER (IEC-146 PT-4)		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VOLTAGE STABILISER		Y	Y	Y	Y	Y					Y		Y				Y	
LEAD ACID BATTERY (PLANTE)-IS-1652																		Y
Ni-CD BATTERY (IS-10918/IEC-623)																		Y
ACDB/DCDB		Y	Y														Y	Y
BATTERY CHARGER		Y	Y	Y	Y	Y				Y					Y	Y	Y	Y
R-Routine Test		A- Acceptance Test						Y – Test applicable										
* Transfer time and Over shoot /under shoot during load & system transfer shall be recorded.																		
Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.																		

QUALITY ASSURANCE

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER													
Test/Attributes Characteristics													
ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Local/ Remote (Open-Stop-Close) Operation®	Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR with Integral Starter , Non- Intrusive Electrical Actuator (EN15714-2)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<p>Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.</p> <p style="margin-left: 40px;">- SIL 2 certificate if applicable</p> <p>® - Routine Test (A) - Acceptance Test Y - Test applicable</p>													

QUALITY ASSURANCE

PROGRAMMABLE LOGIC CONTROLLER , Control Desk, Fire														
ITEMS		Visual ®	GA, BOM ,Lay Out of components ®	Dimensions, Paint Shade/ Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	Wiring , HV & IR ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ Mosaic Items/ Transducers ®	Accessibility of TBS/ Devices ®	Illumination ®	Functional Check for Control Element , Annunciation ®	Mimic ®	Test as per IEC 1131 ® *	Test as per Std ® & (A)
TESTS														
1. PLC Panel		Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y
2. Control Desk With PLC		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
3. LVS		Y	Y	Y	Y	Y	Y	Y					Y	Y
4. Smoke Detectors (UL-268,EN-54 PT-7), Heat Detectors(UL-521/EN 54 PT-5) Annunciation/ Control Panel (UL -864, EN-54, PT-2)														Y
<p>Note: 1) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure along with relevant supporting documents. *Applicable for PLC</p> <p>Y- Test Applicable , ® - Routine Test (A) - Acceptance Test</p>														

QUALITY ASSURANCE

CLOSED CIRCUIT TELEVISION SYSTEM (CCTV) – IP Based									
Attributes Characteristics	Make, Model, Type, Rating, TC®	Dimension/constructional requirement®	Functional/operational check®	Switching capability and sequence®	No. of inputs/outputs, display®	Provision for connectivity with the LVS®	Pan range/speed, tilt/tilt speed®	Operational check from key board/control	Commands from LAN Switch/Network
Item Components Sub System Assembly									
LAN Switch/Network Switch	Y		Y	Y	Y	Y			
Key boards	Y		Y						
Cameras	Y	Y	Y						
Lens	Y	Y	Y						
Camera Housing	Y	Y	Y						
Pan & Tilt unit	Y	Y	Y				Y		
Media Converter	Y		Y						
Monitor	Y	Y	Y						
Software	Y		Y						
Server, Work Station, Storage Device	Y		Y						
Complete System	Y	Y	Y	Y	Y	Y	Y	Y	Y
<p>Note : 1) This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure alongwith relevant supporting documents.</p> <p>R –Routine Test Y -Test Applicable</p>									

QUALITY ASSURANCE

PUBLIC ADDRESS SYSTEM – IP Based							
Attributes Characteristics	Make, Model, Type, Rating, ®	Dimension / constructional requirement®	Functional / operational check®	Switching capability and sequence®	No. of inputs/outputs, display®	SPL level and Sweep test response®	Operational check regarding communication with different zones ®
Item Components Sub System Assembly							
LAN Switch/Network Switch	Y		Y	Y	Y		
Call Stations	Y		Y				
Amplifier (Standalone)	Y		Y				
Power Supply	Y		Y				
Loud Speaker	Y	Y	Y			Y	
EPBAX	Y		Y				
Master Control Unit	Y		Y				
Media Converter	Y		Y				
Software	Y		Y				
Enclosure (Outdoor application)	Y	Y	Y				
Acoustic Hood	Y	Y	Y				
Server, Work Station, Storage Device	Y		Y				
Integrated Testing							Y
<p>Note: 1) This is an indicative list of test/checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and procedure along with relevant supporting documents.</p> <p>R –Routine Test Y -Test Applicable</p>							

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INDICATIVE VENDOR LIST

Disclaimer for Indicative Vendor List

- 1.1 Reasonable efforts have been made to collate the sub-vendors proposed by the various main contractors from time to time against different Projects/Packages and accepted by NTPC for various items. However, in case of error/omission, if any, and represented by the successful bidder this will be addressed during the execution of the contract based on the material evidence available with NTPC / Main Contractor.
- 1.2 The approved sub-vendor list drawn is not based on NTPC driven enlistment process but based on the sub- vendors proposed by various Main Contractors. As such, it is possible that some of the Suppliers/Manufacturers who may be involved in similar work/process may not be appearing in the list as such sub-vendors may not have been proposed by Main Contractors against NTPC Contracts.
- 1.3 In case the successful bidder chooses to propose additional sub-vendors with relevant experience after the award of the contract such sub-vendors will be considered in terms of Clause no: 19.1 of GCC, provided the proposals are received sufficiently in time: 90 days prior to ordering date of a Bought Out Items/Start of Manufacturing so as not to impede the progress of the contract.
- 1.4 Sub-vendors have been grouped under different categories of items. It is possible that an item characterized by certain specific features such as range and type required as per Main Contractor's design requirements may not be in the range of the listed sub-vendor's manufacturing process/capability. As such the main contractor to ascertain the vendor's capability to meet his specific requirements before considering a sub-vendor.
- 1.5 It is to be noted by the bidders that any shortfall in contract performance attributable to the sub-vendor listed will not absolve the contractor from his contractual obligations in any manner.

ANDAMAN & NICOBAR GAS POWER PROJECT(50MW)-EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.: CS-6400-001-2	SUB-SECTION- Q-00 INTRODUCTION TO QUALITY ASSURANCE SPECIFICATION	Page 1 of 2
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- 1.6 The approval was granted based on the evaluation of relevant capabilities and facilities possessed by the sub-vendor at the time of evaluation. Also, some of the sub-vendors may not be active. As such, the successful bidder is to carry out his own due diligence before considering the listed sub-vendor for subletting: the current status of the sub-vendor, the continued availability of productive resources including Human Resources.
- 1.7 The list of sub-vendors is periodically revised to include new sub-vendors. Such a revision may also see a deletion of certain sub-vendors who may have been disqualified on grounds of inadequate performance or banned in line with NTPC's banning policy. The then current list will be shared with the successful bidder immediately on award.

<p>ANDAMAN & NICOBAR GAS POWER PROJECT (50MW)-EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART- B Bid Doc. No.: CS-6400-001-2</p>	<p>SUB-SECTION- Q-00 INTRODUCTION TO QUALITY ASSURANCE SPECIFICATION</p>	<p>Page 2 of 2</p>
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Project/ परियोजना : ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)
 Package/ पैकेज :
 Supplier/ आपूर्तिकर्ता:
 Contract No./ अनुबंध सं.:

INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL
 क्वालिटी प्लान तथा सब -वेंडर के अनुमोदन सहित मदों की सूची
 SUB-SYSTEM उप-प्रणाली: **Mechanical**

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1	AIR BLOWERS -LOBE TYPE ≥ 10 KW (< 10 KW , CAT-II, MAIN CONTRACTOR APPROVED SOURCE)	I			SWAM PNEUMATIC	NOIDA	A		
					EVEREST BLOWERS PVT LTD	BAHADURGARH	A	UP TO 40 HP (APPROX 1600 CUM/HR)	
					KAY INTERNATIONAL	SONEPAT	A	UP TO 4800 CUM/HR	
					KULKARNI POWER TOOLS	SHIROL	A	UP TO 2500CUM/HR	
					USHA COMPRESSORS	AHMEDABAD	A	UP TO 60 HP (APPROX 2000CUM/HR)	
2.A	EOT CRANE & ELECTRIC HOIST >5 MT (≤5 MT CAT-III, MAIN CONTRACTOR APPROVED SOURCE)	I (> 10T) / III (>5T UP TO 10T)			REVA INDUSTRIES	FARIDABAD	A	UP TO 60 MT	
					EDDY CRANE	PUNE	A	UPTO 10 MT	
					CONSOLIDATED HOIST	SATARA /PUNE *	A	SATARA UP TO 60 MT HOIST,*PUNE FOR ELECTRIC HOIST UPTO 15 MT	
					ELECTROTHERAPHY	RISHRA	A	UPTO 15 MT FOR ELECTRIC HOIST ONLY	
					HERCULES HOIST	RAIGAD	A	UPTO 15 MT FOR ELECTRIC HOIST ONLY	
					TUBRO FERGUSSON	KOLKATA	A	UP TO 20MT FOR EOT, UP TO 5 MT FOR ELECTRIC HOIST	
					PRAYAS ENGG (PBL)	V V NAGAR	A	UPTO 10 MT FOR ELECTRIC HOIST ONLY	
					ALPHA SERVICES	ALWAR	A	SINGLE GIRDER EOT CRANE & ELECTRIC HOIST UPTO 15 MT ONLY. GEARBOX FROM NTPC APPROVED SOURCES FOR EOT CRANE.	
					CENTURY CRANE ENGINEERS PVT. LTD	BALLABHGARH	A	UP TO 60 MT EOT CRANE	
					ARMSEL	BANGALORE	A	UPTO 10 MT EOT & UPTO 15 MT ELECTRIC HOIST	
					TRACTEL TIRFOR	PALWAL	A	UPTO 15 MT FOR ELECTRIC HOIST AND UPTO 10 MT FOR EOT	
					MILLARS INDIA	KARAMSAD	A	UP TO 25 MT	
					AVON CRANES	GURGAON	A	UP TO 25 MT	
					GRIP ENGINEERS	HYDERABAD	A	50 MT (GEARBOX FROM NTPC APPROVED SOURCES FOR EOT CRANE).	
					GRIP ENGINEERS	FARIDABAD	A	UPTO 60 MT ELECTRIC HOIST ONLY	
					UNIVERSAL HOIST O FABRIK	THANE	A	CRANE 08 MT & HOIST 60 MT	
					TECHNO INDUSTIES	AHMEDABAD	A	UP TO 60 MT	
					MEGA CRANE INDIA PVT LDT	COIMBATORE	A	UP TO 10 MT	
					MANGALA HOIST	GR NOIDA	A	UP TO 55 MT EOT CRANE & EL HOIST 20 MT	
					CRANEX	GHAZIABAD	A	UP TO 140 MT FOR EOT ONLY	
2.B	GANTRY CRANE >5T (<5 MT CAT-III, MAIN CONTRACTOR APPROVED SOURCE)	I (> 10T) / III (>5T UP TO 10T)			REVA INDUSTRIES	FARIDABAD	A	UP TO 60 MT	
					UNIQUE INDUSTRIAL HANDLERS PVT LTD	NASHIK	A	UP TO 165 MT	
					ANUPAM INDUSTRIES LTD.	ANAND	A	UP TO 60MT	
					SMACO ENGINEERING PVT. LTD	THANE	A	UP TO 60MT	
					MANGLA HOIST	GREATER NOIDA	A	UP TO 10MT	
					CB DOCTOR VENTILLATOR PVT LTD	AHMEDABAD	A	up to 50000 CMH	
					HOWDEN AIR AND GAS INDIA PVT LTD(FORMERLY HOWDEN SOLYVENT INDIA PVT LTD)	CHENNAI	A	up to 125000 CMH	
					C DOCTOR &CO PVT LTD	KOLKATA	A	up to 50000 CMH	
					KRUGER VENTILATION INDUSTRIES (I) PVT LTD	SHAHPUR, THANE	A	Up to 6000 CMH	
					NADI AIRTECHNICS PVT LTD	CHENNAI	A	Up to 15000 CMH	
3	FAN- AXIAL TYPE ≥ 10KW (< 10 KW , CAT-II, MAIN CONTRACTOR APPROVED SOURCE) MOTOR FROM NTPC ACCEPTED SOURCE	II			ADVANCE VENTILATION PVT LTD	KUNDALI, SONEPAT	A	up to 40000 CMH	
					SUVIDHA AIR SOLUTIONS PVT LTD	GANDHINAGAR	A	up to 50000 CMH	
					SK SYSTEMS PVT LTD	KUNDALI PHASE-II, SONEPAT, HARYANA	A	up to 50000 CMH	
					Patel Airflow	Ahemdabad	A	up to 40000 CMH	
					ALMONAROD (P) LIMITED	CHENNAI	A	Up to 14000 CMH	
					STEEL AUTHORITY OF INDIA LIMITED	ROURKELA	A		
					WELSPUN	ANJAR	A	SAW UPTO 2600 NB	
					WELSPUN	BHARUCH	A	SAW UPTO 1300 NB	
					MAN INDUSTRIES	INDORE	A	SAW UPTO 1400 NB	
					SAMSHI	VADODARA	A	SAW 450 TO 2540 NB	
4	PIPES-MS- (BLACK/ GI) AS PER IS IS:3589 >1000NB	I			MUKAT TANKS & VESSELS	TARAPUR	A	SAW 200 TO 1200 NB	
					MUKAT PIPES	RAJAPURA	A	SAW UPTO 1800 NB	
					LALIT PIPES AND PIPES LTD	THANE	A	SAW 350 TO 1400 NB	
					RATNAMANI	CHATRAL	A	SAW 600 TO 2600 NB	
					RATNAMANI	KUTCH	A	SAW 400 TO 3600 NB	
					PSL HOLDINGS LIMITED	DAMAN	A	SAW 450 TO 1600 NB	
					PSL INTERNATIONAL LTD.	CHENNAI	A	SAW 450 TO 1600 NB	
					PSL LIMITED	KUTCH	A	SAW 450 TO 1600 NB	
					PSL LIMITED	VISAKHAPATNAM	A	SAW 450 TO 1600 NB	
					JCO PIPES	CHHINDWARA	A	SAW UPTO 1600 NB	
					SURYA ROSHNI	ANJAR	A	SAW UP TO 2032 OD	
					JINDAL SAW LTD	BELLARY	A	SAW UP TO 3632 OD, THICKNESS 16 MM	
					CAPACITE STRUCURES PVT LTD	THANE	A	406.4 MM TO 3874 MM OD	
					DRIPLX WATER ENGINEERING INTERNATIONAL PVT LIMITED	BHADARBAD	A		
					BGR ENERGY SYSTEMS LTD (ENVIRONMENTAL ENGG. DIV.)	PONNERI	A	UPTO 3000MM DIA & THICKNESS UPTO 28 MM	
ISHAN EQUIPMENTS PRIVATE LIMITED	VADODARA	A	UPTO 2900 MM DIA & THICKNESS UPTO 28 MM						



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5	SERVICE VESSEL & OTHER PR VESSELS >= 10 BAR WORKING PRESSURE	I			JASMINO POLYMERTECH PVT LTD	TALOJA	A		DIA 2800MM, THICKNESS 25MM DESIGN PRESSURE UP TO 47.5 KSC
					MAHIMA UDYOG	HARIDWAR	A		DIA UP TO 2900 MM , THICKNESS UPTO 29 MM
					SV Fabricators	Navi Mumbai	A		
					BELCO POLLUTION CONTROL PVT LTD	GREATER NOIDA	A		UPTO 3200MM DIA & THICKNESS UPTO 30 MM
6	PUMPS- HORIZONTAL & VERTICAL CENTRIFUGAL -UP TO 300KW	(≥10KW & <90 KW CAT-II , ≥ 90 KW CAT-I)			KIRLOSKAR BROTHERS LTD	KIRLOSKARWADI	A		Vertical Wet Pit & Non-Pull-Out Type Pump Set – 200 Kw Motor rating, Horizontal Centrifugal Pump 2.2 KW
					WILO MATHER & PLATT	SATARA	A		
					WILO MATHER & PLATT	KOLHAPUR	A		
					SAM TURBO	COIMBATORE	A		FLOW UP TO 1500 CUM/HR AND POWER RATING UP TO 425 KW
					FLOWMORE LTD	GHAZIABAD	A		
					BEST AND CROMPTON	CHENNAI	A		
					JYOTI LTD	VADODARA	A		
					WPIL	GHAZIABAD	A		
					KISHORE PUMPS	PUNE	A		UPTO 500M3/HR ONLY RUBBERLINED PUMPS ALSO
					GRUNDFOS PUMPS INDIA PVT LTD	CHENNAI	A		HORIZONTAL UP TO 30 KW ONLY AND VERTICAL UP TO 45 KW ONLY (FOR APPLICATIONS WHERE NPSH IS NOT REQUIRED)
					SINTECH PRECISION	GHAZIABAD	A		HORIZONTAL UP TO 400 KW MOTOR RATING AND VERTICAL UP TO 30 KW MOTOR RATING
					KSB	PUNE	A		
					KSB	NASHIK	A		
					FLOWSERVE INDIA CONTROLS PVT LTD	COIMBATORE	A		HORIZONTAL CENTRIFUGAL PUMP UP TO 75 KW ONLY
					SU MOTOR	MUMBAI	A		HORIZONTAL UPTO 500M3/HR ONLY RUBBERLINED PUMPS AND VERTICAL CENTRIFUGAL PUMPS UP TO 100CMH ONLY
					BHARAT PUMPS AND COMPRESSORS	NAINI	A		FLOW UP TO 2200 M3/HR AND HEAD UP TO 60 MWC
7	PUMPS -VT -UP TO 300KW	I			FLOWMORE LTD	GHAZIABAD	A		
					KIRLOSKAR BROTHERS LIMITED	KIRLOSKARWADI	A		
					WPIL LTD	KOLKATA	A		
					WPIL LTD	GHAZIABAD	A		
					JYOTI LTD	VADODARA	A		
					XYLEM WATER SOLUTIONS INDIA PVT LTD	VADODARA	A		
					FLOWSERVE INDIA CONTROLS PVT LTD	COIMBATORE	A		UP TO 1025 KW
					SINTECH PRECISION	GHAZIABAD	A		
					WILO MATHER & PLATT	PUNE	A		
8.A	VALVE-DUAL PLATE CHECK > 600MM OR CLASS > 300 (VALVE- DUAL PLATE CHECK UP TO 600MM & CLASS 300: CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			ADVANCE VALVE PVT LTD	GR. NOIDA	A		DUAL PLATE CHECK VALVES CI UPTO 1000 NB CLASS 125, DUPLEX SS UP TO 600NB CLASS 600.
					LEADER VALVES	JALANDHAR	A		UP TO 900MM CLASS 150 , SS 200NB CLASS#300
					R & D MULTIPLE	VALSAD	A		CI/ CS UP TO 800NB PN 10
8.B	VALVE-BALL > 100 MM OR CLASS > 800; (VALVE- BALL UP TO 100 MM & CLASS 800:CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			SWIMS TECHNOLOGIES	HUBLI	A		SS BALL VALVES UP TO 500MM AND CLASS #600, CS BALL VALVES UP TO 250 MM AND CLASS# 900, CS/ SS BALL VALVES UP TO 100 MM AND CLASS # 1500.
					MICRO FINISH VALVES PVT. LTD.	HUBLI	A		400NB CLASS#600 AND UP TO 600NB CLASS#300
					FLOW CHEM INDUSTRIES	KALOL	A		100NB CLASS#600,200NB CLASS#300, 50 NB CLASS#800
					L&T VALVES LIMITED	COIMBATORE	A		UPTO 150NB, CLASS #150/300, AND UPTO 50NB, CLASS #800
					PRECISION ENGG CO VALVES PVT LTD	NASIK	A		FCS UP TO 50NB CLASS 800, CCS UP TO 400NB CLASS 150.
					WELLCAST INDUSTRIES	AHMEDABAD	A		SIZE 150 NB & PR CLASS 150
					A V VALVES	AGRA	A		size up to 250 NB & Class 150
					BELGAUM AQUA VALVE PVT LTD	BELGAON	A		FCS UP TO 50NB CLASS 800, CCS UP TO 200NB CLASS 150.
					G M ENGINEERING PRIVATE LTD	RAJKOT	A		UP TO 400 NB AND CLASS #600
					INTERVALVE POONAWALA LTD	PUNE	A		SGI / CI / D2 1400MM PN10, SGI / CI 1000MM PN16,CS/SS 500MM PN16, SS 400MM CLASS#300, MS FABRICATED UPTO 2000NB, PN 6
					SWIMS TECHNOLOGIES	HUBLI	A		CI/ DI BUTTERFLY VALVE UP TO 1000MM AND PN16 AND UP TO 1800MM AND PN10,CCS UP TO 1050MM CLASS 150 AND UP TO 1800MM AND PN16 SS - UP TO 400NB PN-16 ,FABRICATED 800MM CLASS#150.
					PENTAIR VALVES	HALOL	A		FOR SS UP TO 500 NB PN-10, CI- UP TO 900NB PN-10, UP TO 500NB PN-16, 450MM CLASS#300., MS FABRICATED UPTO 2800NB, PNG.



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INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL
 क्वालिटी प्लान तथा सब -वेंडर के अनुमोदन सहित मदों की सूची
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8.C	VALVE-BUTTERFLY > 600MM OR CLASS>150 (VALVE-BUTTERFLY UP TO 600MM & CLASS 150::CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			FOURES ENGINEERING	BANGALORE	A		CAST SGI/CI/ MS FABRICATED- UP TO 1200 PN-10, UP TO 350 PN-16 ,2400 MM PN6/CLASS150 SS - UP TO 300NB PN-10,MS FABRICATED UPTO 2700NB CLASS # 75
					KIRLOSKAR BROTHERS LTD	KIRLOSKERWADI	A		CAST SGI/CI/CS 1400 MM PN16 , SS 300 MM PN16 , 1800MM CLASS 150, MS FABRICATED 900 NB PN40,MS FABRICATED 2800NB, PN6.
					R & D MULTIPLE	VALSAD	A		CAST SGI/CI/MS FABRICATED- UP TO 1800 MM PN-10/CLASS # 75 , 1100MM PN25,1400MM CLASS#150 MS FABRICATED UPTO 2800NB CLASS # 75
					ADVANCE VALVES PVT LTD	GREATER NOIDA	A		METAL SEATED, TRIPLE ECCENTRIC, SS BVF OF SIZE UPTO 100NB, AND PRESSURE RATING UPTO CLASS #300.
					BRAY CONTROLS INDIA PVT. LTD	KANCHIPURAM	A		UPTO 450 MM AND CLASS#600
					INSTRUMENTATION LTD.	PALAKKAD	A		UPTO 2200NB CLASS # 75
					HAWA ENGINEERS	AHMEDABAD	A		CI/ CS & FABRICATED UPTO 1200MM, CLASS #150, SS UPTO 250MM, CLASS#150
					CRANE PROCESS FLOW	SATARA	A		UP TO 900MM PN10
					L & T VALVES LIMITED	COIMBATORE	A		UP TO 900MM CLASS 150
					DEMBLA VALVES	THANE	A		UP TO 2200MM CLASS#75
8.D	VALVE-CONVENTIONAL GATE / GLOBE / CHECK(> 600NB OR CLASS > 300 AND ≤ 600 NB & CLASS 300 CAT-III, MAIN CONTRACTOR APPROVED SOURCE)	II			LEADER VALVES	JALANDHAR	A		CS GATE 600MM CLASS#600, SS GLOBE 600MM CLASS#600, CS CHECK 600MM AND CLASS#600
					HAWA ENGINEERS	AHMEDABAD	A		FCS / FSS 50 NB CLASS 800.
					FOURES ENGINEERINGS	THANE	A		400NB CLASS 600 AND 50NB CLASS 800.
					BHEL IVP	GOINDWAL	A		GATE UP TO 300 NB CLASS 600. GLOBE 250 NB CLASS 400, CHECK 150NB CLASS 600.
					HITECH ENGG PVT LTD	AHEMDABAD	A		50 NB CLASS 800.
					KSB PUMPS LTD	COIMBATORE	A		300NB CLASS 2500.
					NITON VALVES INDIA PVT LTD	NAVI MUMBAI / AURANGABAD	A		CS GATE 900 NB CLASS 600, CHECK 300 NB CLASS 600.
					L&T VALVES LIMITED	COIMBATORE	A		650 MM CLASS 600, 50 NB CLASS 800.
					SWIMS TECHNOLOGIES	HUBLI	A		CONVENTIONAL CCS GATE / GLOBE / CHECK VALVES UP TO 600MM AND CLASS # 1500, CSS GATE/ GLOBE/ CHECK VALVES UP TO 200MM AND CLASS # 600, FCS GATE / GLOBE / CHECK VALVES UP TO 50MM AND CLASS # 2500.
					8.E	VALVE- DIAPHRAGM TYPE	I		
SWIMS TECHNOLOGIES	HUBLI	A		UPTO 250 NB - PN 10, 350MM PN6					
PROCON ENGINEERS	MUMBAI	A		UPTO 200 NB AND PN 10/CLASS #150 & 250NB- PN-6 RATING					
8.F	VALVE-PLUG > 100 MM OR CLASS > 800(VALVE- PLUG UP TO 100 MM & CLASS 800:CAT-II & MAIN CONTRACTOR APPROVED SOURCES)	I			SWIMS TECHNOLOGIES	HUBLI	A		SOFT SEATED 400MM AND CLASS #150, 300NB CLASS#300
					XOMOX SANMAR	TRICHY	A		UP TO 600MM AND CLASS#300
					FLOWSERVE INDIA CONTROLS	CHENNAI	A		METALLIC SEATED 400NB CLASS#150, 300NB CLASS #300, 50NB CLASS #800
9	PUMP -SUBMERSIBLE/SUMP>= 30KW < 30 KW CAT-II, MAIN CONTRACTOR APPROVED	I			KSB	NASHIK	A		130 KW
					KIRLOSKAR BROTHERS LTD	KIRLOSARWADI	A		
					AQUA MACHINERY	AHMEDABAD	A		
					WPIL	GHAZIABAD	A		UP TO 235 KW
10	DELUGE VALVE WITH TRIMS	I			HD FIRE	THANE/JALGAON	A		
					CARRIER	GURGAON	A		
					ANSUL	USA	A		FOR PISTON TYPE DELUGE VALVE ONLY
11	INERT GAS EXTINGUISHING SYSTEM	II			KIDDE (GINGEKERR)	UK	A		
					NAFFCO	UAE	A		
					MINIMAX Gmbh & Co. KG	GERMANY	A		
					TOTAL WALTHER	GERMANY	A		
					NOHMI BOSAI	JAPAN	A		
					HD FIRE	THANE	A		
12	ALARM VALVE WITH TRIMS	II			HD FIRE	JALGAON	A		
					HD FIRE	JALGAON	A		
13	FOAM SYSTEM(BLADDER TYPE)	I			FIRETECH	RATNAGIRI	A		
14	FIRE TENDER	I			WADIA BODY BUILDERS	AHMEDABAD	A		
					AAREL INDUSTRIES	INDORE	A		
					AMBALA COACH	AMBALA	A		
					VIJAY FIRE	UMBERGAON	A		
					MARATHON ELECTRIC MOTOR(I) LTD	KOLKATA	A		UP TO 50000 CMH
15	CENTRIFUGAL FAN (≥10KW), (< 10 KW , CAT-II, MAIN CONTRACTOR APPROVED SOURCE), MOTOR FROM NTPC ACCEPTED SOURCE	I			HOWDEN AIR AND GAS INDIA PVT LTD(FORMERLY HOWDEN SOLYVENT INDIA PVT LTD)	CHENNAI	A		UP TO 200000 CMH
					ALMONAROD (P) LIMITED	CHENNAI	A		UP TO 60000 CMH
					PATEL AIRFLOW	VATWA, AHMEDABAD	A		UP TO 250000 CMH
					CB DOCTOR VENTILATOR PVT LTD	AHMEDABAD	A		UP TO 150000 CMH
					WOLTER VENTILATORS INDIA (P) LTD	BHIWADI,	A		UP TO 200000 CMH
					C DOCTOR &CO PVT LTD	KOLKATA	A		KUP TO 250000 CMH
					SUVIDHA AIR SOLUTIONS PVT LTD	AHMEDABAD	A		UP TO 190000 CMH



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INDICATIVE LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL
 क्रमालिटी प्लान तथा सब -वेंडर के अनुमोदन सहित मदों की सूची
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					SUBURBAN INDUSTRIAL WORKS PVT. LTD	KOLKATA	A		UP TO 100000 CMH
					KRUGER VENTILATION INDUSTRIES (I) PVT LTD	THANE	A		UP TO 90000 CMH
					SOLYVENT FLAKT	KOLKATA	A		UP TO 200000 CMH
					ADVANCE VENTILATION PVT LTD	SONEPAT	A		UP TO 250000 CMH
					SK SYSTEMS PVT LTD	SONEPAT	A		UP TO 250000 CMH
16	DIESEL ENGINE	I			CUMMINS	PUNE	A		Up to 2000 KVA
					PERKINS	AURANGABAD	A		UP TO2000 KVA DG SET
17	GAS ENGINE	I			VENDOR LIST SHALL BE TIED UP WITH BIDDER AFTER FINAL AWARD OF CONTRACT				
					SAIL	ROURKELA	A		
					RATNAMANI	KUTCH	A		UP TO 1100 NB
18	3 LPE COATED PIPE	I			JINDAL SAW LTD	BELLARI	A		UP TO 1300 MM
					ArcelorMittal Nippon steel India Ltd	HAZIRA	A		UP TO 910 MM
					PSL LTD	KUTCH/ VIZAC	A		UP TO 1100 NB
					TRANTER INDIA	PUNE	A		HT PLATES & GASKETS FROM TRANTER SWIDEN/USA,HT PLATES FROM HISKA JAPAN
19	PLATE HEAT EXCHANGER	I			ALPHA LAVAL	SATARA	A		HT PLATES & GASKETS FROM ALPHA LAVAL SWIDEN
					IDMC	ANAND	A		HT PLATES & GASKETS FROM SONDEX DENMARK
					SONDEX INDIA	VADODARA	A		HT PLATES FROM SONDEX DENMARK/INDIA (MODEL S188)
20	DI(Ductile Iron) PIPE & FITTINGS	I			JINDAL SAW(J161)	KUTCH	A		UP TO DN 900 CLASS K7 & K9
					JAI BALAJI(J156)	BARDWAN	A		UP TO DN 900 CLASS K7 & K9
					ELETRO STEEL	SRIKALAHASTHI	A		DI PIPES-900NB K7
					ELETRO STEEL	KOLKATA	A		
21	AIR COPMPRESSOR: OIL FREE CENTRIFUGAL COMPRESSOR	I			INGERSOLL RAND INDIA	AHEMDABAD	A		Capacity Upto 60 NM3/Minute @ Pr 8 bar
					KIRLOSKAR PNEUMATIC COMPANY LTD	PUNE	A		Capacity up to 65 Nm3/min and pressure rating up to 8.0 kg/cm2
22	OIL FREE SCREW TYPE AIR COMPRESSORS	I			ATLAS COPCO	BELGIUM (ASSEMBLING & TESTING AT ATLOS COPCO , PUNE).	A		Capacity Upto 75 NM3/Minute @ PR 8.0 KG/CM2(g) and 100 NM3/Minute @ PR 4 KG/CM2
					INGERSOL RAND INDIA	AHMEDABAD	A		UPTO MODELSH 300 (36 NM3/MIN) . AIR ENDS FROM GHH RAND - GERMANY & OTHER COMPONENTS FROM IR'S GLOBAL SOURCES ASSEMBLY & TESTING AT INGERSOL- AHMEDABAD
					ELGI	COIMBATORE	A		UPTO 2830 CFM,
					AERZEN MACHINES	VADODARA	A		6520 M3/Hr @ 2.58 bar
					KIRLOSKER PNEUMATIC COMP LTD	PUNE	A		FLOW CAPACITY 65 NM3/MIN AND PRESSURE RATING 8 KG/CM2
23	AIR DRYER	I			SUMMIT'S HYGRONICS	COIMBATORE	A		FOR REFRIGERANT DRYER, 11893 M3/HR, REGENERATIVE DRYERS BLOWER REACTIVATED TYPE 2123 M3/HR AND REGENERATIVE DRYERS HOC TYPE 5820 M3/HR
					MELLCON ENGRS PVT LTD	GR NOIDA	A		Refrigerant type 7285 m3/hr & REGENERATIVE DRYERS HOC TYPE 2548 M3/HR
					DELAIR INDIA LTD	GURGAON	A		Refrigerant type 7500 m3/hr & REGENERATIVE DRYERS HOC TYPE 3000 M3/HR
					SUMESH PETROLEUM	VADODARA	A		100 CFM(169 M3/HR) & 7 KG/CM2
					ATLAS COPCO	BELGIUM(ASSLY & TESTING AT PUNE)	A		MODEL UP TO FD1200
					INDCON	DELHI	A		Regenerative dryer2500 m3/hr HOC & DECICANT TYPE
					TRIDENT PNEUMATIC PVT LTD	COIMBATORE	A		Refrigerant type 10000 m3/hr & REGENERATIVE DRYERS BHR TYPE 1000 M3/HR
24	SCREW CHILLER	II			KIRLOSKAR CHILLER	PUNE	A		UP TO 350TR
					DAIKIN	NEEMRANA	A		UP TO 185 TR
					KIRLOSKAR CHILLER PVT LTD	PUNE	A		Up to 350TR
					BLUE STAR (COMPRESSOR FROM HANBEL-TAIWAN)	WADA	A		SCREW CHILLER UP TO 282TR
					INDIANA GRATINGS PVT. LTD.	PUNE	A		
					JINDAL STEEL & POWER LTD.	RAIGARH	A		
					BABY ENGG. PVT. LTD.	TRICHY	A		
					REGIONAL ENGG. WORKS	TRICHY	A		
					AJANTHA FABS	MATHURA	A		
					CAPACITE STRUCTURES LTD.	THANE	A		
					MIURA INFRASTRUCTURE PVT. LTD.	BHILAI	A		
					SHIVAM HITECH STEELS PVT. LTD	BHILAI	A		
					TECHNOFAB MANUFACTURING LTD.	CHENNAI	A		
					JSW SEVERFIELD STRUCTURES LTD(JSSL)	BELLARY	A		
					ALLIANCE INTEGRATED METALIKS LTD(AIML)	RAJPURA	A		
					ATMASTCO PVT LTD	DURGAPUR	A		
					APEX BUILDSYS LTD	NAGPUR	A		



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25	SHOP FABRICATED STRUCTURE (> 5T SINGLE PIECE) Fabricated Steel Structure (Single Piece upto 5 MT and Rolled Section-CAT-III)	I			COREFAB PROJECTS PVT LTD	BHILAI	A		
					KOTHARI CHEMICALS	BHILAI	A		
					FEDDERS LLOYD CORPORATION LTD	SIKANDRABAD	A		
					ARCELOR MITTAL DHAMM PROCESSING PVT LTD	RANIPET	A		
					ARTSON ENGINEERING	NASIK	A		
					ARTSON ENGINEERING	NAGPUR	A		
					HEAVY ENGINEERING WORKS	REWA, MP	A		
					ARCELORMITTAL NIPPON STEEL INDIA LTD	CHENNAI	A		
					TRIDENT FABRICATORS PVT LTD	ROURKELA	A		
					GREAT INDIA STEEL FABRICATORS	YAMUNA NAGAR	A		
					METALFAB HITECH	NAGPUR	A		
					SUPERTECH INDIA	G.NOIDA	A		
					GOODLUCK STEEL	SIKANDRABAD	A		
					BTL	KOLKATA	A		
					BTL	DURGAPUR	A		
					AMIYA COMMERCE	KOLKATA	A		
					NAMDHARI INDUSTRIAL	LUDHIANA	A		
					Ambabhawani Fab Engg Works LLP	Rajnandgan	A		
					SRSHTI METALS PVT. LTD.	SONEPAT	A		(SINGLE ITEM UPTO 10MT)
					ANIL STEEL PVT. LTD.	SONEPAT	A		(SINGLE ITEM UPTO 10MT)
Jagdamba Structural Pvt. Ltd.	RAIGARH	A		(SINGLE ITEM UPTO 5 MT)					
Kalyani Alloy Casting	NADIA	A		(SINGLE ITEM UPTO 10MT)					
Golden Engineering Industries	Durg	A		Single piece up to 5 MT					
THYSSENKRUPP INDUSTRIES INDIA	HYDERABAD	A							
26	PIPE-SS ASTM A 312(ERW/ SEAMLESS) (*TCs TO BE VERIFIED BY MAIN CONTRACTOR)	ERW-II/ SEAMLESS-III*			REMI	TARAPUR	A		ERW UPTO 400 NB,SEAMLESS UP TO 200NB
					RATNAMANI	MEHSANA	A		ERW UPTO 500 NB, SS SEAMLESS - OD up to 168.3, thickness up to 3.4 mm, as per ASTM SA 312 Grade-TP 304
					RATNAMANI	KUTCH	A		ERW UPTO 400 NB, SEAMLESS UPTO 50 NB ONLY, ARC WELDED UP TO 450NB
					BHANDARI FOILS & TUBES LIMITED	DEWAS	A		ERW UP TO 300NB
					APEX	BEHRORE	A		ERW UPTO 400 NB, SEAMLESS UPTO 50 NB.
					PRAKASH STEELAGE	SILVASA	A		ERW UP TO 203NB
					SHUBHLAXMI METALS AND TUBES	UMBERGAON	A		SEAMLESS UP TO 150MM and ERW UP TO 250 NB Sch 40S
27	PIPE-CS SEAMLESS ASTM A 106 (*TCs TO BE VERIFIED BY MAIN CONTRACTOR)	III*			ISMT	AHMADNAGAR	A		UPTO 273 MM OD
					ISMT	BARAMATI	A		UPTO 273 MM OD
					REMI	BHARUCH	A		UPTO 177.8 MM OD
					MAHARASHTRA SEAMLESS	RAIGAD	A		UPTO 500 NB
					EPP COMPOSITES PVT LTD	RAJKOT	A		UP TO 900MM
28	PIPES & FITTINGS-GRP	I			GRAPHITE INDIA	NASIK	A		UP TO 1000MM
					SHRIRAM SEPL.COMPOSITES LTD	CHENNAI	A		UP TO 1100MM
					BALAJI FIBER REINFORCE PVT LIMITED	VADODARA	A		UP TO 650MM
					MEGHA FIBRE GLASS INDUSTRIES PVT LTD	MEDAK	A		UP TO 900MM

ITEM WITH MAIN CONTRACTOR / BIS APPROVED SOURCES.

1	BRANCH PIPE , COUPLING & NOZZLE (SS & GM)	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE				
2	FIRE EXTINGUISHER	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE				
3	WATER MONITOR	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE				
4	PIPES-MS- (BLACK/ GI) AS PER IS:1239 & IS:3589 UPTO 1000 NB	II			(BIS MARKED, MANUFACTURERS WITH VALID BIS LICENSE)				
5	FIRE HOSE	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE				
6	HYDRANT VALVE	II			BIS APPROVED SOURCES WITH VALID BIS LICENSE				
7	PIPES FOR IDLERS IS 9295	III			BIS APPROVED SOURCES WITH VALID BIS LICENSE				
8	BLOWERS, CENTRIFUGAL FAN,AXIAL FAN <10 KW	II			MAIN CONTRACTOR APPROVED SOURCES				
9	PIPING FABRICATION -HP>300PSI	II			MAIN CONTRACTOR APPROVED SOURCES				
10	PUMP-METERING/DOSING	II			MAIN CONTRACTOR APPROVED SOURCES				
11	PUMP - PP- ACID/ ALKALI UNLOADING	II			MAIN CONTRACTOR APPROVED SOURCES				
12	PUMPS-SCREW TYPE	II			MAIN CONTRACTOR APPROVED SOURCES				
13	RUBBER LINING OF TANKS/ VESSELS/ PIPES/ VALVES/FITTINGS	II			MAIN CONTRACTOR APPROVED SOURCES				
14	RO PRESSURE TUBE	II			MAIN CONTRACTOR APPROVED SOURCES				
15	TUBE SETTLER MEDIA	II			MAIN CONTRACTOR APPROVED SOURCES				
16	WRAPPING & COATING MATERIAL -ANTI CORROSIVE TAPE	II			MAIN CONTRACTOR APPROVED SOURCES				
17	Horizonatal & Vertical Centrifugal Pumps (< 10 KW Motor rating)	III			MAIN CONTRACTOR's APPROVED SOURCES				
18	AXIAL & CENTRIFUGAL FAN(< 10 KW)	II			MAIN CONTRACTOR's APPROVED SOURCES				



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	CASSETTE/SPLIT/WINDOW AC/ PACKAGED AIR CONDITIONER/CONDENSING UNIT	III			MAIN CONTRACTOR'S APPROVED SOURCES				
19	Gate- Sluice/Isolation Gate	II			MAIN CONTRACTOR'S APPROVED SOURCES				
20	Chlorine Toner	II			PESO Approved				
21	Chlorinator with accessories like FRP Cabinete, Vacuum/DP Ragulator, Pressure/Vacuume Relief Valve, Flow Control Valve, Check/Drain Valve, Injector	II			MAIN CONTRACTOR'S APPROVED SOURCES				
22	Chlorine Evaporator with accessories like espansion chamber, safety reliefe valve	II			MAIN CONTRACTOR'S APPROVED SOURCES				
23	Chlorine Gas Filter	II			MAIN CONTRACTOR'S APPROVED SOURCES				
24	Miscelenious items: Filter Media (Sand/Gravel), FMR Media, Fume/Moisiture/CO2 Absorber, Resin/Media/OpenTrap, Diffusers, Static/Venturi Mixure, Dissolving Baskets, Bar Screens, Ejectors, Agitator, PP Strainers/balls, Filters/Strainers-Y Type/Basket Type, RO Skid/ UF Skid-Fabrication/ Centrifuge, Foot/Float Valve, Gun Metal Valve, Oil Water Separater, Oil Skimmer, Activated Carbon, RO Sampling Panel, UF/RO Membrane, Micron Catridge Filters & Housing, Resin-Ion Exchange, Lamella Clarifier- Fabrication, Reactor Clarifier/ Clarifoculator/ Sludge Thckiners-Fabrication, PVC/CPVC/HDPE-Pipes/Valves/ Fittings/ Tanks, FRP Vessels & Tanks, Fittings/Elanges-MS/CS/SS.	III			MAIN CONTRACTOR'S APPROVED SOURCES				
Note-1	Items for which Sub-QR is envisaged, vendors are accepted subject to Sub-QR clearance from NTPC Engg.								
Note-2	The items not covered in the above list shall be mutually discussed & agreed for Item categorisation & sub-vendor control.								

A - For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any./ इन मदों के लिए प्रस्तावित वेंडर एनटीपीसी को स्वीकार्य है। अनुमोदन की शर्त, , यदि कोई हो, के साथ-साथ पत्र "क" में इंगित किया जाए।
DR - For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list. एनटीपीसी द्वारा इन मदों की समीक्षा के लिए "विस्तृत ब्यौरे की आवश्यकता" होगी। सूची में "DR" पत्र में इंगित किया जाना चाहिए।
QP / INSPECTION CATEGORY:
CAT-I / श्रेणी- I: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया जाता है और एनटीपीसी द्वारा अंतिम स्वीकृति भौतिक निरीक्षण के दौरान उपलब्ध गवाह के आधार पर दी जाएगी।
CAT-II / श्रेणी- II: For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP. इन मदों के लिए गुणवत्ता योजनाओं को एनटीपीसी द्वारा अनुमोदित किया
CAT-III/ श्रेणी-III : For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.
UNITS/WORKS इकाईयां / कार्य: Place of manufacturing/ निर्माण का स्थान Place of Main Supplier of multi units/works/बहु- इकाईयों / कार्यों के मुख्य सप्लायर का स्थान.
FORMAT NO./ ग्रहण सं: QS-01-QAI-P-1B/F1-R0 **Engg. Div. / QA&I**

				Sudhir Power Ltd	Silvassa	A		Up to 1 MVA, 11 KV Class
				Hammond Power Solutions	Hyderabad	A		Up to 95 KVA, 33KV Class
				Indcoil Transformers Pvt Ltd	Murbad	A		Up to 600 KVA, 6.6KV Class
5	INSULATING OIL	CAT I						
				Apar Industries	Rabale/Silvassa	A		
				Power Oil Petroleum Products	Silvassa	A		
				NYNAS NAPHTHENICS AB	SWEEDEN / USA	A		
				Kanden Engg Corp Ltd	Japan	A		
				Rai Petro Specialities	Chennai/Silvassa	A		
				Savita Oil Technologies	Mumbai/ Silvassa	A		
6	HT MOTORS	CAT - I						
				HYOSUNG	KOREA	A		UPTO 11KV 13.5 MW
				WEG	BRAZIL	A		UPTO 11KV 2150 KW
				WEG	0	A		UPTO 11KV 14 MW
				BHEL	BHOPAL	A		RQP
				HYUNDAI	KOREA	A		UPTO 11KV 17 MW
				TECO	TAIWAN	A		UPTO 11KV 12 MW
				TMEIC	JAPAN	A		UPTO 11KV 14 MW
				CONVERTEAM	FRANCE	A		UPTO 11KV 18 MW (*DOCUMENTS FOR NAME CHANGE TO GE CONVERTEAM SHALL BE SUBMITTED FOR APPROVAL)
				ABB	VADODARA	A		UPTO 6.6KV 2500 KW 11KV 2000 KW FOR PUMP/ FAN/ COMPRESSOR UPTO 6.6KV 750KW FOR MILL, UPTO 6.6 KV 1300KW FOR CRUSHER WITH SCOOP COUPLING
				IJLIN	KOREA	A		UPTO 11KV 2900 KW, 6.6KV 2500 KW
				IYOTI	VADODARA	A		UPTO 6.6 KV 2250 KW EXCEPT CRUSHER & MILL APPLICATION
				MARATHON	KOLKATA	A		RQP, UPTO 6.6 KV 1300 KW FOR CRUSHER WITH SCOOP COUPLING & 11 KV 1600 KW FOR OTHER APPLICATION EXCEPT CRUSHER & MILL
				CGL (D5 INDUSTRIAL AREA)	MANDIDEEP	A		UPTO 1650 KW 6.6 KV, 1350 KW 11 KV FOR PUMP, FAN, COMPRESSOR. UPTO 3.3 kv 335 kW WITH FLEXIBLE COUPLING FOR MILL APPLICATION
				CGL(PLOT 9)	MANDIDEEP	A		UPTO 11 KV 4MW FOR PUMP/FAN/COMPRESSOR
				CG ELECTRIC SYSTEM	HUNGARY	A		UPTO 3.3 KV 1100 KW
				TMEIC	BENGALURU	A		UPTO 11 KV 5000 KW
7	LT MOTOR	CAT - I						
				ABB	FARIDABAD	A*	* SUBJECT TO VERIFICATION VISIT	UPTO 55KW
				ABB	BANGALORE	A		UPTO 690V, 475kW
				IYOTI LTD.	VADODARA	A		
				TIPM	JAPAN	A		UPTO 15 KW (NON FLAME PROOF)
				HYOSUNG	SOUTH KOREA	A		
				WEG	BRAZIL	A		
				HYUNDAI	SOUTH KOREA	A		
				LHP	SOLAPUR	A		UPTO 400KW FROM B-16 WORKS. UPTO 200KW FROM B-11 WORKS.
				CGL	AHMEDNAGAR	A		RQP, FOR FLAME PROOF MOTOR
				TMEIC	JAPAN (NAGASAKHI)	A		
				NGEF	BANGALORE	A		UPTO 15 KW
				BHARAT BIJLEE	MUMBAI	A		RQP, FOR FLAME PROOF ALSO
				KEC	BANGALORE/ HUBLI*	A		*UPTO 90KW, RQP, FOR FLAME PROOF ALSO
				MARATHON	KOLKATA	A		RQP (UPTO 690V & 600 KW) FOR FLAME PROOF ALSO
				ABB	SWEEDEN	A		UPTO 55KW
				HAVELL	NEEMRANA	A		UP TO 90KW
				KAWAMATA	JAPAN	A		UP TO 75 KW
				HEM Industries	DAMAN	A		UP TO 30 KW
				TIPS	JAPAN	A		UP TO 45KW
7.1	DC Motor (refer Note-7)	CAT I						
8	Numerical Relays	CAT I						
				SEL	Pullman, USA	A		
				GE T&D	Stafford, UK	A		P14X, P34X, P44X, P64X, P74X models
				GE T&D	Chennai	A		P14X, P24X, P34X, P44X, P64X, P74X models
				ABB	Finland	A		

			ABB	Baroda	A	For 6XX Series
			GE Multilin	Zamudio, Vizcaya, Spain/ Markham, Ontario, Canada	A	F-650 only
			Schneider	Stone- UK , Vassa- Finland	A	PX30, PX40, VAMP 5X and VAMP 2XX models
			Siemens	Germany	A	
			Siemens	Goa	A	7SX Series only
			Schneider Electric	Bengaluru	A	
			Schneider Electric	Latvia	A	P3, P5 series, conditions applicable- FAT at Chennai works
9.1	LT Switchgear -Floor mounted Draw out type indoor switchgear Panel (MCC, ACDB / DCDB etc.)	CAT I				
			Schneider (formerly L&T)	Mumbai / Coimbatore/ Ahmednagar	A	
			C&S Electric	Noida / Haridwar	A	
			Schneider	Nasik	A	ACB from Schneider, France
			Siemens	Kalwa	A	Conditions apply
			Schneider	Vadodara	A	
			BCH ELECTRIC LIMITED	FARIDABAD	A	ACB from Schneider Electric India
			Pyrotech	Udaipur	A	
9.2	LT Switchgear - Floor mounted Fixed type indoor LT Switchgear Panel (MLDB)	CAT I				
			Switching Circuits	Kolkata	A	
			Hindustan Control & equipment Ltd	Kolkata	A	With fabrication & painting at unit II & MP Electrical Narendrapur
			Maktel	Vadodara	A	Prior Type Testing
			Jakson	Greater Noida	A	
			Vidyut Control	Gaziabad	A	
			Adlec Power	Rohad (Jhajjar)	A	
			Conquerent Control System	Manesar	A	Condition apply ,upto 1250A
			Control & Schematics	Hyderabad	A	
			Positronics	Vadodara	A	
			Schneider (formerly L&T)	Mumbai / Coimbatore/Ahmednagar	A	
			GE	Bangalore	A	
			C&S Electric	Noida/ Haridwar	A	
			Schneider	Nasik	A	
			Pyrotech	Udaipur	A	
			Siemens	Kalwa	A	
			Tricolite	Sahibabad/Manesar	A	
			Schneider	Vadodara	A	
			BCH ELECTRIC LIMITED	FARIDABAD	A	ACB from Schneider Electric India
			Nitya Electrocontrols	Noida	A	
9.3	LT Switchgear - Wall mounted fixed type indoor / outdoor LT Switchgear non compartmentalized Panel (Lighting panels / AC / DC Fuse boards etc.)Power Panel , Emergency Lighting Panel	CAT I				
			Control Devices	Kolkata	A	
			Jasper	Noida	A	
			Havells	Faridabad	A	
			Novateur Electrical & distribution systems	Murthal	A	
			Avoid Technovator	Manesar	A	
			Switching Circuits	Kolkata	A	
			Hindustan Control & equipment Ltd	kolkata	A	With fabrication & painting at unit II & MP Electrical Narendrapur
			Maktel	Vadodara	A	
			Jakson	Greater Noida	A	
			Vidyut Control	Gaziabad	A	
			Adlec Power	Rohad (Jhajjar)	A	
			Conquerent Control System	Manesar	A	Condition apply ,upto 1250A
			Control & Schematics	Hyderabad	A	
			Positronics	Vadodara	A	
			L&T	Mumbai / Coimbatore/ Ahmednagar	A	
			GE	Bangalore	A	
			C&S Electric	Noida / HARIDWAR	A	
			Schneider	Nasik	A	
			Pvrotech	Udaipur	A	
			Siemens	Kalwa	A	
			Tricolite	Sahibabad/ Manesar	A	
			Nitya Electrocontrols	Noida	A	
			BCH ELECTRIC LIMITED	FARIDABAD	A	ACB from Schneider Electric India
			Saravana Switchgear	Bengaluru	A	

9.4	LT Switchgear - Floor mounted Fixed type indoor LT Switchgear Panel (MLDB)	CAT I							
				Switching Circuits	Kolkata	A			
				Hindustan Control & equipment Ltd	Kolkata	A		With fabrication & painting at unit II & MP Electrical Narendrapur	
				Maktel	Vadodara	A		Prior Type Testing	
				Jakson	Greater Noida	A			
				Vidyut Control	Gaziabad	A			
				Adlec Power	Rohad (Jhajjar)	A			
				Conquerent Control System	Manesar	A		Condition apply ,upto 1250A	
				Control & Schematics	Hyderabad	A			
				Positronics	Vadodara	A			
				Schneider (formerly L&T)	Mumbai / Coimbatore/Ahmednagar	A			
				GE	Bangalore	A			
				C&S Electric	Noida/ Haridwar	A			
				Schneider	Nasik	A			
				Pyrotech	Udaipur	A			
				Siemens	Kalwa	A			
				Tricolite	Sahibabad/Manesar	A			
				Schneider	Vadodara	A			
				BCH ELECTRIC LIMITED	FARIDABAD	A		ACB from Schneider Electric India	
				Nitya Electrocontrols	Noida	A			
9.5	LV Air Circuit Breaker	CAT II							
				C&S Electric	Noida	A			
				L&T	Mumbai	A			
				GE	Bangalore	A			
				Siemens	Germany	A			
				Schneider	France	A			
9.6	LT CT/PT/CBCT/ Control Transformer	CAT II							
				Kappa	Bangalore	A			
				Southern Electric	Chennai	A			
				Precise	Mumbai	A			
				G&M	Baroda	A		CBCT Only	
				Silkaans	Mumbai	A			
				Ind Coil	Mumbai	A			
				Pragati	Thane	A			
				Prayog	Pune	A			
				AE	Mumbai	A			
				Logicstat	Delhi	A		For control transformer only	
				Newtek	Aurangabad	A		For CT/PT/Control transformer	
11	MV Switchgear Panel	CAT I							
				BHEL	Bhopal	A		Upto 33KV	
				Megawin	Salem	A*		Upto 33KV	*SUBJECT RESOLUTION OF SITE ISSUES
				Schneider Electric India (Formerly L&T)	Ahmednagar	A		Upto 33KV	
				Siemens	Mumbai	A		Upto 33KV	
				ABB	Nasik	A		Upto 33KV	
				Schneider	Vadodara	A		Upto 11KV	
				Schneider (Salt lake works)	Kolkata	A		Upto 11KV	
11.1	MV Vacuum Type Circuit Breaker	CAT I							
				Siemens	Mumbai	A		Upto 33KV	
				BHEL	Bhopal	A		Upto 33KV	
				L&T	Ahmednagar	A		Upto 33KV	
				ABB	Nasik	A		Upto 33KV	
				ABB	Italy	A		Upto 33KV	
				Megawin	Salem	A		Upto 33KV	
				Jyoti	Vadodara	A		Upto 33KV	
				Schneider	Kolkata	A		Upto 11KV	
11.2	MV CT / PT & CBCT	CAT I							
				Kappa	Bangalore / Chennai	A		Upto 33 KV	
				Pragati	Navi Mumbai / Murbad	A		Upto 33 KV	
				AE	Mumbai	A		Upto 33 KV	
				Prayog	Pune	A		CT only (Upto 24KV), conditions apply	
				JSL	Mogar	A		Upto 33KV	
				ECS	Baroda	A		Upto 33KV	
				Paras Power	Bangalore	A		Upto 11KV	
				Narayna Power Tech	Vadodara	A		Upto 11KV, conditions apply	
				Huphen	Nasik	A		Upto 11KV, conditions apply	
				BMC	Kolkatta	A		Upto 11KV, conditions apply	

12	LT VFD Control Panel	CAT I								Upto 55 KW with following conditions: i) VFD from Schneider- France, upto 415V, 50KW. ii) Enclosure & bought out items shall be from NTPC acceptable makes & iii) Engineering support for integration will be provided by Schneider / Authorized integrator of Schneider
					Powertech	Sonepat		A		
					DANFOSS	Oragadam		A		(upto 690V, 1200kW), VFD drives with VFD sourced from Danfoss-Denmark/USA and Panel sourced from Rittal
					YASAKAWA	Japan		A		VFD from Yasakawa- Japan, Upto 415V, 132KW
					YASKAWA	BANGALORE		A		UPTO 575kW/690V
					ROCKWELL AUTOMATION	SAHIBABAD		A		VFD from Rockwell(Allen Bradley)- USA, (Upto 415 V, 600 KW)
					ABB	BANGALURU		A		VFD from ABB-Bengaluru, Upto 415V, 250 KW
					ABB	BANGALURU		A		VFD from ABB-Finland, Upto 690V, 1500 KW
					SIEMENS	NASIK		A		VFD from SIEMENS- Germany, Upto 690V,900KW
					SEIPL	Navi Mumbai		A		LT VFD upto 575KW, 690V
					AMTECH	GANDHINAGAR		A		UP TO 75KW RATING
					VACON	BANGALORE		A		VFD(NXP model) from VACON Finland, upto 400KW,415V and upto 900KW, 690V
13	MV VFD Control Panel	CAT I			HITACHI HI REL POWER ELECTRONICS PVT. LTD.	SANAND		A		up to 11 KV rating
					TMEIC INDUSTRIAL SYSTEMS INDIA PRIVATE LIMITED	TUMKUR		A		up to 11 KV rating
14	Fire sealing system - Type A Material supplier									
		CAT II			3M India	Bangalore		A		
		CAT III*			GE Silicon	USA		A		*WITH MTC
		CAT III*			Hilti	Germany		A		*WITH MTC
		CAT III*			DOW Corning	USA		A		*WITH MTC
14.1	Fire sealing system - Type B Material supplier	CAT II								
					LLOYDS	Delhi		A		
					Signum	Nagpur		A		
					Vijay System Engineers Pvt Ltd	Valsad		A		
14.2	Executing Agency for Fire sealing system	CAT I								
					LLOYDS	Delhi		A		
					Signum	Nagpur		A		
					Vijay System Engineers Pvt Ltd	Valsad		A		
					3M India	Bangalore		A		
15	ACSR CONDUCTOR	CAT I								
					APAR INDUSTRIES	SILVASSA		A		
					CABCON	KOLKATA		A		
					DIAMOND	VADODARA		A		
					GALAXY	SANGLI		A		
					GUPTA POWER INFRA	BHUBANESWAR		A		
					HIRA CABLES	HIRAKUD		A		
					JSK	SILVASSA		A		
					LUMINO	KOLKATA		A		
					SARAVATHY	BANGALORE		A		
					HIREN ALUMINIUM	SILVASSA		A		
					SMTTA	GHAZIABAD		A		
					SASHI CABLES LTD	LUCKNOW		A		
					Mahavir Transmission Limited	DEHRADUN		A		
15.1	ALUMINIUM TUBE	CAT I								
					ALOM EXTRUSIONS UNIT-II	BALASORE		A		
					BANCO	VADODARA		A		
					CENTURY EXTRUSION	KOLKATA		A		
					HINDALCO	RENUKOOT		A		
					HINDALCO	ALUPURAM		A		
					JINDAL ALUMINIUM	BANGALORE		A		
					SUDAL	NASIK		A		
16	AB Tariff energy meter	CAT I								
					SEMS	Udairpur/Solan		A		
					Elster	Mumbai		A		
					L&T	Mysore		A		For Model ER300P With CMS software.

17	SPV module	CAT I		BHEL	Bangalore	A		
				Warree	Surat	A		
				Emmvee	Bangalore	A		
				Vikram Solar	Parganas	A		
				Lanco Solar	Chattisgarh	A		
				Tata Power Solar	Bangalore	A		
				Alpex	Solan	A		
				Synergy	Durgapur	A		
				Photonix	Satara	A		
				HHV Solar	Bangalore	A		
17.1	Power Conditioning Unit (PCU)	CAT I		Schneider	Bangalore	A		Conditions apply
				ABB	Bangalore	A		Conditions apply
				Bongfiglioli	Germany	A		Conditions apply
				Fecon	Germany	A		
				AEG	Bangalore	A		Conditions apply
				Hitachi-Hirel	Gandhinagar	A		Conditions apply
				Hitachi-Hirel	Sananad	A		Conditions apply
				Vacon	Bangalore	A		Conditions apply
17.2	String Monitoring Box (SMB)	CAT II		Trinity Touch	Palwal	A		Conditions apply
				Hensel	Sriperumbudur	A		Conditions apply
				AEG	Bangalore	A		Conditions apply
				Statcon	Pilkhuwa	A		Conditions apply
				Weidmuller	Spain	A		Conditions apply
18	EHV Cables	CAT I		Iijin Electric	South Korea	A		For 132KV & 220 KV only
				KEC International	Vadodara	A		Upto 220KV
				KEI Industries	Bhiwadi	A		Upto 132KV , 220KV
				Phelps Dodge	Bangkok	A		For 132 KV only
				LS CABLE & SYSTEM LTD	South Korea	A		Up to 400 KV
				LS CABLE & SYSTEM LTD	BHIWADI	A		Up to 132 KV
				Universal Cable Ltd.	Satna	A		Upto 132KV only
19	H.T. CABLE upto 33KV	CAT I		Apar Industries	Umbergaon	A		Upto 33kV
				Gemscab	Bhiwadi	A		Upto 33kV
				Gupta Power	Kashipur	A		Upto 33kV
				Havells India Ltd.	Alwar	A		Upto 11kV
				KEC International	Vadodara	A		Upto 33kV
				KEI Industries	Bhiwadi	A		Upto 33kV
				Krishna Electrical Industries Ltd	Gwalior	A		Upto 11kV
				Polycab Wires Pvt. Ltd	Daman	A		Upto 33kV
				Tirupati Plastomatics	Jaipur	A		Upto 11kV
				Torrent Cable Ltd	Nadaid	A		Upto 33kV
				CMI	Baddi	A		Upto 11kV
				Universal Cable Ltd.	Satna	A		Upto 33kV
				Dynamic Cables	Reengus	A		Upto 33kV
				Paramount Communications	Khushkhera	A		Upto 33kV
20	1.1 KV LT Power Cables (Type- XLPE Insulated, PVC sheathed (incl FRLS)	Refer Note-5		Advance Cable	Bengaluru	A		
				Apar Industries Ltd	Umbergaon	A		
				Cords Cables	Bhiwadi	A		
				CMI	Baddi	A		
				Delton Cable Ltd	Faridabad	A		
				Dynamic Cables	Jaipur	A		
				Gemscabs Industries	Bhiwadi	A		
				Gupta Power Cables	Khurda	A		
				Havells India Ltd.	Alwar	A		
				KEC International	Silvassa , Mysore	A		
				KEI Industries	Bhiwadi	A		
				Paramount Cable	Khushkhera	A		
				Polycab Wires Pvt. Ltd	Daman	A		
				Ravin Cables	Pune	A		
				Special Cables	Rudrapur	A		
				Suyog Electricals Ltd	Halol	A		
				Thermocables	Hyderabad	A		
				Tirupati Plastomatics	Jaipur	A		
				Torrent Cable Ltd	Nadiad	A		
				Universal Cable Ltd.	Satna	A		
				Ravi Industries	Sonepat	A		
				Chandresh Cables	Gandhinagar	A		

21	LT Control Cable 1.1 KV, Type - PVC (incl FRLS)	Refer Note-5							
					Advance Cable	Bengaluru	A		
					Apar Industries Ltd	Umbergaon	A		
					Cords Cables	Bhiwadi	A		
					CMI	Faridabad	A		
					CMI	Baddi	A		
					Delton Cable Ltd	Faridabad	A		
					Elkay Telelink	Faridabad	A		
					Gemscabs Industries	Bhiwadi	A		
					Goyline Fibres (I) Ltd	Daman	A		
					Gupta Power Cables	Khurda	A		
					Havells India Ltd.	Alwar	A		
					KEC International	Silvassa , Mysore	A		
					KFI Industries	Bhiwadi	A		
					Paramount Cable	Khushkhera	A		
					Polycab Wires Pvt. Ltd	Daman	A		
					Ravin Cables	Pune	A		
					Special Cables	Rudrapur	A		
					Suyog Electricals Ltd	Halol	A		
					Thermocables	Hyderabad	A		
					Tirupati Plastomatics	Jaipur	A		
					Torrent Cable Ltd	Nadiad	A		
					Universal Cable Ltd.	Satna	A		
					Chandresh Cables	Gandhinagar	A		
22	DC Batteries (Lead acid Plante type BATTERY)	CAT I							
					Hoppekke	Brilon,Germany	A		
					Exide	Kolkata	A		
22.1	DC Batteries (Ni-Cd type BATTERY)	CAT I							
					HBL-Power System	Hyderabad	A		Up to 990 Ah with conditions
					Saft India	Bangalore	A		8Ah to 990Ah- KPH type
							A		10Ah to 1365 Ah- KPM type
							A		11Ah to 1550Ah – KPL type
22.2	BATTERY CHARGER (48V/110V/220V)	CAT I							
					Amararaja	Tirupati	A		
					HBL- Power System	Hyderabad	A		
					Chhabi electrical	Jalgaon	A		
					EXIDE	Kolkatta	A		
					Statcon	Hapur	A		Up to 220 V, 850 A
					Dubas	Bangalore	A		Up to 220 V, 800 A
					VERTIV	PUNE	A		UPTO 220V
					BANAVATHY POWER PRIVATE SYSTEMS LTD.	Bangalore	A		UPTO 220V,100A
					SERVILINK ENGINEERS PRIVATE LIMITED	Vadodara	A		UPTO 220V,100A
22.3	Battery Health Monitoring System	CAT I							
					EXIDE	Kolkatta	A		
					HBL- Power System	Hyderabad	A		
					Exide	Kolkata	A		OLD NAME: CHLORIDE POWER
23	GI CABLE TRAYS AND ACCESSORIES (LADDER & PERFORATED TYPE), fitting & accessories including bends	Refer Note-6							
					Inar Profiles Ltd	Enkapalli (Vishakhapatnam)	A		
					Vatco	Mumbai	A		Galvanization at Sigma Mumbai
					Indiana cable trays	Mumbai	A		Galvanization at Karamtara galvanizer- Mumbai
					Industrial Perforation	Kolkata	A		Galvanized and offered for inspection at Industrial Perforation Pvt Ltd, Ganganagar , Kolkata, WB
					Ratan Projects	Bagnan	A		In black condition from M/s Ratan Projects, Sankrail
					India Electric Syndicate	Kolkata	A		Galvanization at BMW Industries/B.P Projects- Howrah
					Steelite engg.	Mumbai	A		
					Premier Power Products	Howrah	A		Galvanising at Neha Galvaniser- Howrah
					Indiana Gratings	Pune	A		
					M.J. Engineering	Okhla/ Bhiwadi	A		
					Maheshwari	Ghaziabad	A		Galvanization at NTPC approved Galvaniser.

			T.R.G	Chennai	A	Galvanization at TM Radhakrishna Chetty & Co-Chennai	
			Amtech	Pune	A	Galvanization at B.G. Shirke - Pune	
			Kannade Anand Udyog	Mumbai	A	- Fabrication at their units: Plot No. 42, Morivali, MIDC, Thane & Plot No.: D-35 Anand Nagar MIDC, Addl. Ambernath , Thane - Galvanization and offer the galvanized trays for inspection at: Plot No. D-34 Anand Nagar MIDC, Addl. Ambernath,Thane	
			Rukmani	Raipur	A	Ladder type cable trays only	
			Passive Infra	Hasangarh (Rohtak)	A		
			Unitech Fabricators & Engineers	Howrah/ Hoogly	A		
			Patny System	Hyderabad	A		
			Rabi Engg	Kolkata	A	Galvanizing from NTPC approved sources	
			MKSD Industries	Taloja	A	Galvanization from Encorp Power Trans- Palghar	
			Reliable Sponge	Kalunga	A		
			Pinax Steel	Patna	A		
			Rukmani	Hoogly	A	Galvanization at Rukmani Fab & Gal-Howrah	
			RMG Steels Pvt Ltd	Noida	A	Galvanization at Shivam Engineers and Fabricators, Ghaziabad	conditions apply
			EROS METAL WORKS (P) LTD	Nagpur	A	Galvanization at M/S EROS INFRASTRUCTURE PVT. LTD., HAVING WORKS ADDRESS AS G-97, M.L.D.C. INDUSTRIAL AREA, BUTIBORI, NAGPUR-441103	
23.1	GI FLEXIBLE CABLE TRAY SUPPORT SYSTEM	Refer Note-6					
			Vatco	Mumbai	A	Galvanising at Sigma Mumbai	
			Inar profiles	Enkapalli	A		
			Industrial perforations	Kolkata	A		
			Premier power products	Howrah	A	Galvanising at Neha Galvaniser-Howrah	
			Steelite engg.	Mumbai	A		
			Indiana gratings	Pune	A	Galvanising at Poona Galvaniser- Pune	
			Amtech	Pune	A	Galvanising at B.G. Shirke- Pune	
			Ratan Projects	Howrah	A	Galvanization at NTPC approved sources	
			Patny Systems	Hyderabad	A		
24	Galvanised Steel Structure(other than Switchyard & Transmission line GI structures)	CAT II					
			Sangam Structural Ltd	Prayagraj	A	Galvanising at NTPC approved sources	
			RS Infraprojects	Ghaziabad	A		
			Anil Steels	Rohtak	A		
			Jamuna Metals	Delhi	A		
			Pioneer Fabricators	Meerut	A		
			Passive Infraprojects	Rohtak	A		
			PAVITRA INDUSTRIES	HYDERABAD	A	GALVANISATION TO BE DONE FROM GURPREET GALVANIZERS HYDERABAD	
25	Elevator (Gear Type)	CAT I					
			Otis	Mumbai	A		
			Kone	Chennai	A	Gear Type and MRL Type	
			Techno	Ahmedabad	A	Gear Type and MRL Type	
			Omega	Ahmedabad	A		
			ECE	Ghaziabad	A		
			Semel Eltec	S Korea	A		
			Johnson	Nagpur	A		
26	SPBD	CAT I					
			BHEL	Rudrapur	A		
			C&S	Haridwar	A		
			GODREJ & BOYCE MANUFACTURING COMPANY LTD	Bangalore	A		
			Powergear	Hindupur	A		
			Powergear	Chennai / Bangalore	A		
			KGS Engg.	Chennai	A		
26.1	Air Insulated Non Segregated phase type LT busduct	CAT I					
			C&S Electric	G.Noida	A		

			C&S Electric	HARIDWAR	A			
			Unilec	Gurgaon	A		Upto 3200 A	
			Stardrive	Chennai	A			
			Spaceage Swgr Ltd	Bawal	A			
			RPEP	Chennai	A			
			Enpro	Chennai	A			
			Nitya Electrocontrols	Noida	A			
			PYROTECH ELECTRONICS PVT. LTD.	UDAIPUR	A		UPTO 4000A	
26.2	Sandwiched type LT Busduct	CAT I						
			Godrej	Bangalore	A			
			Henikwon	Malaysia	A			
			C&S	HARIDWAR	A			
27	Neutral Grounding Transformer	CAT II						
			Pragati Electrical Pvt. Ltd.	Mumbai	A			
			Bharat Biljee Ltd.	Navi Mumbai	A			
			Pravog Electrical Ltd.	Pune	A			
			Andrew Yule	Chennai	A			
28	132 KV cable termination & straight through jointing kits	CAT I						
			Ilin	South Korea	A			
			ABB Kabledon	Sweden	A			
			Pfisterer AG	Switzerland	A			
			Tyco Electronics Ravchem GmbH	Germany	A			
29	Cable Termination kits and straight through jointing kits	CAT II						
			3M Electro & communication	Pune	A		Upto 33KV	
			Ravchem	Mumbai	A		Heat shrinkable type upto 33KV	
			Hari consolidated	Delhi	A		Heat shrinkable type upto 33KV	
30	Lighting Mast with raise & Lower Type Lantern Carriage / Polygonal Poles	CAT I						
			Bajaj	Pune	A			
			BP Projects	Kolkata	A			
			Skipper	Howrah	A			
			Transrail Lighting	Silvassa	A			
			AVAIDS TECHNOVATORS	Alwar	A			
30.1	Lighting poles- Tubular/ polygonal	CAT I						
			Main contractor approved souces having BIS Licensee/ ISI marked with CML Number					
30.2	Lighting fixtures with accessories (LED type)	CAT I						
			Wipro	Pune	A			
			Surya Roshni	Noida	A			
			Bajaj	Mumbai	A			
			Philips	Noida	A			
			Pyrotech	Udaipur	A			
			Mika	Thane	A			
			GOLDWYN LIMITED	NOIDA	A			
31	DG SET(ASSEMBLER & TESTING)	CAT I						
			Kohler	Singapore	A		Up to 1500 KVA, 11KV	
			CLLS	Singapore	A		Up to 1250 KVA, 415 V.	
			Powerica	Silvasa	A		Up to 2000 KVA, 415 V & 1500 KVA, 11 KV	
			Sterling Generators Pvt Ltd	Silvasa	A		Up to 415 V 2000 KVA	
			Supernova	Rajpur(Mehsana)	A		Up to 415 V 2000 KVA	
			JAKSON	PHALTAN	A		Up to 415V 1750KVA	
31.1	ALTERNATOR	CAT I						
			Kirloskar Electric	Bangalore	A		415 V alternators	
			Cummins Generator Technology (Stamford)	U.K	A		415 V & 11 KV alternators	
			Leroy Somer	France	A		Up to 11KV alternator 3500 kW	
			Marathan	USA	A		Alternators for up to 415 V, 1500 KVA DG SET	
			Cummins Generator Technology (Stamford)	Ahmednagar	A		415 V Alternators up to 1600 KVA	
			Toyo Denki Power System	Bangalore	A		11 KV, 1500 KVA	
31.2	DG Set Control panel / Synchronising panel	CAT I						
			L&T	Mumbai / Coimbatore/ Ahmednagar	A			
			GE	Bangalore	A			
			Siemens	Mumbai	A			
			C&S Electric	Noida / HARIDWAR	A			
			Schneider	Nasik	A			
			Unilec	Gurgaon	A			
			Nitya Electrocontrols	Noida	A			
			Switching Circuits	Kolkata	A			
			Tricolite	Sahibabad / Manesar	A			
			Hindustan Control & equipment Ltd	Kolkata	A		With fabrication & painting at unit II & MP Electrical Narendrapur	

				Maktel	Vadodara	A			
				Jakson	Greater Noida	A			
				Vidyut Control	Gaziabad	A			
				Adlec Power	Rohad (Jhajjar)	A			
				Pyrotech	Udaipur	A			
				Anand Power Ltd.	Noida	A			
				Positronics	Vadodara	A			
				Control & Schematics	Hyderabad	A			
				Sterling Generators Pvt Ltd	Silvassa	A			
				Supernova	Rajpur	A			
Items Identified as Main Contractor approved sources									
MC 1	Continuous Cast Copper Rod	CAT III							
MC 2	Unimpregnated Densified Wood	CAT III							
MC 3	Marshalling Box Components	CAT III							
MC 4	Air Cell	CAT III							
MC 5	Terminal Connector	CAT III							
MC 6	Oil Flow Indicator	CAT III							
MC 8	Pressure Relief Valve	CAT III							
MC 9	Magnetic Oil Level Gauge	CAT III							
MC 10	OTI/WTI (RTD Type)	CAT III							
MC 11	Off-Circuit Tap Changer	CAT III							
MC 12	Cooling Fan & Motor Assembly	CAT III							
MC 13	Silica Gel Breather	CAT III							
MC 14	Bushing Metal Parts	CAT III							
MC 15	Copper Conductor Bus Bar	CAT III							
MC 16	Copper Foil/Sheet for Dry Type Transformer	CAT III							
MC 17	Core cheese assembly for Bus Reactor	CAT III							
MC 18	Core Clamps & OLTC Bracket, Core/Tie Bolt, Rods & Nuts	CAT III							
MC 19	Epoxy Casting Material for Dry Type Transformer	CAT III							
MC 20	Fibre Glass Covered Copper Conductor for Dry Type Transformer	CAT III							
MC 21	Fibre Glass Sheet for Dry Type Transformer	CAT III							
MC 22	Gaskets	CAT III							
MC 23	Hardwares	CAT III							
MC 24	Motor for OLTC	CAT III							
MC 25	Sheet Metal Enclosure for Dry Type Transformer	CAT III							
MC 26	Steel Plate & Pipe	CAT III							
MC 27	Tank Fabrication up to 5 MVA	CAT III							
MC 28	Temperature Surveillance Unit for Dry Type Transformer	CAT III							
MC 29	Valves (for Radiator/Gun Metal/CI valves etc.)	CAT III							
MC 30	Gas Collecting Device	CAT III							
MC 31	Networking of Numerical Relay	*(with Switchgear MQP)							
MC 32	Paint	CAT III							
MC 33	Copper for Copper Flats & Copper strips/flexibles	CAT III							
MC 34	OIL PURIFYING EQUIPMENT	CAT III							
MC 35	Oil Tanker (wheel mounted),10 kL capacity	CAT III							
MC 36	POST INSULATOR	CAT II							
MC 37	DISC INSULATOR/ PIN INSULATOR	CAT II							
MC 38	FIBRE OPTIC CABLE	CAT I							
MC 39	EVENT LOGGER	CAT III							
MC 40	GPS TIME SYNCHRONISATION EQUIPMENT	CAT III							
MC 41	RELAY TEST KIT	CAT III							
MC 42	DISTURBANCE RECORDER	CAT III							
MC 43	OPERATIONAL ANALYSER WITH DCRM KIT	CAT III							
MC 44	FOTE	CAT II							
MC 45	OPGW	CAT II							
MC 46	LARGE VIDEO SCREEN (LVS)	CAT III							
MC 47	Porcelain Insulator	CAT III							
MC 48	Lighting & Welding Transformer	CAT III							
MC 49	Industrial /Welding receptacle & boxes	CAT III							
MC 50	MS Rod/GI Strip/Flat and Wire for Earthing & Lightning protection	CAT III							

NOTE	L2 LIST OF SWITCH GEAR							SOURCES FOR THESE ITEMS SHALL BE FINALIZED DURING DETAILED ENGINEERING AND MQP FINALIZATION
1	Numerical Relays	CAT I						SUB-QR CLEARED VENDORS ARE ACCEPTABLE FOR NUMERICAL RELAYS
2	Silver Plating	CAT III						
3	MCBs	CAT III						
4	ENERGY METER	CAT III						
5	H.V. Fuse	CAT III						
6	Terminal Blocks (Control)	CAT III						
7	Surge Capacitors	CAT II						

Note - 1 : Vendors to submit project specific documents as per Sub-QR requirements in case the Vendor is approved under collaboration agreement.

Note - 2: Vendors under 'A' are approved and accepted by NTPC with/without conditions in the past. Similar conditions as the case may be for the vendor shall be applicable for this project and tied up in the quality plan.

Note - 3: Main contractor approved sub vendors are acceptable those are evaluated / assessed as per Main contractor Quality Management System for vendor approval. Main contractor to inform the finally selected vendor to NTPC as soon as PO is placed for these items. In case of sub-QR Note-1 is also applicable.

Note - 4 : BOI shall be reviewed and finalised during MQP approval for items/systems where ever applicable.

Note - 5: Category of Inspection for LT Cables:

For Total Contract Quantity per Size	Category Of Inspection
For cable total quantity \leq 2.5 KM	Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years
For cable total quantity above 2.5 km & up to \leq 10 km per size/type	Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years
For cable total quantity 10 km and above per size/type	Cat-I

Note - 6: Category of Inspection for Cable Trays & Cable Tray Flexible Support System:

For Total Contract Quantity per Size	Category of Inspection
For cable total quantity \leq 2.5 KM	Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years
For cable total quantity above 2.5 km & up to \leq 10 km per size/type	Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years
For cable total quantity 10 km and above per size/type	Cat-I

Note - 7:

- i) For Motors less than 50 KW: CAT-III. Acceptance of Motor less than 50 KW is based on COC of the Manufacturer and the Main Contractor confirming as follows: "It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp, voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets".
- ii) For Motors 50 KW and less than 75 KW : CAT- II. Acceptance of Motor is based on NTPC review of Routine Test inspection report as per IS: 12615 / applicable standards duly witnessed by main contractor along with COC of the Manufacturer and the Main Contractor confirming as follows: "It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp, voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets".
- iii) For Motors 75 KW & above : CAT- I. AS PER NTPC APPROVED QUALITY PLAN (To be submitted separately for NTPC review & approval).
- iv) DC motors (all rating) - Inspection CAT-I

NTPC approved Galvanizers:			
1. M/s M J Engg,Delhi	7. M/s National Galvanizer, Kolkata	13. M/s Gurpreet Galvanizer, Hyderabad	19. Unitech Fabricators & Galvanizers- Hoogly
2. M/s A.V. Engg, Kolkata	8. M/s Unistar Galvanizer, Kolkata	14. M/s Sigma, Mumbai	20. Shivam Engineers and Fabricators, Ghaziabad
3. M/s Inar Profiles, Vishakapatnam	9. M/s B.P. Project, Kolkata	15. M/s Radhakrishnan Shetty, Chennai	
4. M/s Anand Udyog, Mumbai	10. M/s Bajaj Pune	16. Karamtara Mumbai	
5. M/s Techno Engg,Chandigarh	11. M/s Electrocure Industries, Mumbai	17. Poona Galvanizers Pune	
6. M/S Steelite Engg, Mumbai	12. M/s B.G. Shirke, Pune	18. Neha Galvanizer- Kolkata	

Note - 9: Relevant certificates shall be submitted for NTPC approval.Approval conditions attached to above identified vendors, as applicable shall be adhered to.

Note - 10 : Indigenou sub-vendors for Annexure-I items are acceptable subject to meeting the MLC (Minimum Local Content) in line with latest MOP order.

LEGENDS / संकेतिका

SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY /माली अनुमति/ स्तर -वेरर की स्वीकृति की स्थिति की श्रेणी (SHALL BE FILLED BY NTPC एस्टीमैटो द्वारा भरा जाएगा)

A - For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any./ इन मल्ले के लिए अनुमति वेरर एस्टीमैटो को स्वीकार्य है। अनुमोद की शर्त, यदि कोई हो, के साथ-साथ पत्र "क" में इंगित किया जाए।

DR - For these items "Detailed required" for NTPC review. To be identified with letter "DR" in the list. एस्टीमैटो द्वारा इन मल्ले की समीक्षा के लिए "विकल्प स्वीर की आवश्यकता" होगी। सूची में "DR" पत्र में इंगित किया नगर चाहिए।

QP/INSPN CATEGORY: स्वीर / वरिष्ठा की श्रेणी:

CAT-I / श्रेणी-I: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. इन मल्ले के लिए गुणवत्ता योजनाओं को एस्टीमैटो द्वारा अनुमोदित किया जाता है और एस्टीमैटो द्वारा अंतिम स्वीकृति शैतिक वरिष्ठा के दौरान उपलब्ध गारर के अधार पर दी जाएगी।

CAT-II / श्रेणी-II: For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP. इन मल्ले के लिए गुणवत्ता योजनाओं को एस्टीमैटो द्वारा अनुमोदित किया जाता है। हालांकि एस्टीमैटो द्वारा कोई शैतिक वरिष्ठा नहीं किया जाएगा। एस्टीमैटो द्वारा अंतिम स्वीकृति अनुमोदित स्वीर के अधार स्तानों की समीक्षा के अधार पर दी जाएगी।

CAT-III/ श्रेणी-III : For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.

UNITS/WORKS इकाइया / काम: Place of manufacturing/ वरिष्ठा का स्थान Place of Main Supplier of multi units/works/बहु-इकाइया / कामों के मुख्य सप्लर का स्थान.

: Control measure of item covered in quality plan of main item.

Format No./ गारर सं: QS-01-QAI-P-1B/F1-R0

Engg. Div. / QA&I

NTPC		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)					LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES									DATE :	
		CONTRACT :										
		CONTRACT NO :										
					Axis	Sweden		A			1-CCTV components will be of Axis communication AB,Sweden make & Video Management Software will be of Milestone Brand. 2.Other BOI items shall be from LOA approved sources & will be tied up during the finalization MQP.	
					Bosch	Bengaluru		A			1.CCTV components will be of M/S Bosch make, and supplied through M/s Bosch, Bengaluru. 2.Other BOI items shall be from LOA approved sources & will be tied up during the finalization MQP.	
					Honeywell Security & Fire	Gurugram		A			1. CCTV Active Components make Honeywell, China. 2.Other BOI items shall be from LOA approved sources & will be tied up during the finalization MQP.	
					Pelco	USA		A			1.CCTV components will be of M/S Pelco, USA make 2.Other BOI items shall be from LOA approved sources & will be tied up during the finalization MQP.	
5A	CCTV System (IP Based) /System Integrators											
					Willstrong Solution Pvt Ltd	Greater Noida		A			1.Major component like PTZ Camera its accessories, Joystick, VMS from Honeywell and other BOI like OWS, LAN Switch shall be as per LOA agreed sources. 2- Engineering document like MQP should be vetted by M/s Honeywell.	
					Jonson Control India Pvt Ltd	Mumbai		A			M/S Pelco Make CCTV system	
					Toshniwal Industrial Pvt Ltd	Ajmer		A			M/S Axis Make CCTV system	
					L&T Technology Service	Bengaluru		A			M/S Bosch Make CCTV system	
					Score Information Technologies Limited	Kolkata		A			M/S Bosch Make CCTV system	
					Netware Computers	New Delhi		A			M/S Honeywell China Make CCTV system	
6	Control Desk											
					Pyrotech Workspace Solutions Pvt Ltd	Udaipur		A			BOI items like Mosaic tiles /Console items shall be as per LOA approved sources	
					Cosmos Media Products Pvt Ltd	Greater Noida		A			1.BOI items like Mosaic tiles /Console items shall be as per LOA approved sources 2. H block should be from knurr Germany .Solid acrylic surface should be procured from Du Pont/NTPC approved sources 3.Extruded Al profile structure should be procured from Hindalco (With Knurr design)	
					Adarsha Control system Pvt Ltd	Bengaluru		A			1.BOI items like Mosaic tiles /Console items shall be as per LOA approved sources 2. Acrylic solid surface (ASS) should be procured from Du Pont /NTPC approved sources 3.wood works are to be done by M/S C K Furn Bengaluru	
7	Control valve											
					Mascot Valves Pvt Ltd	Ahmedabad		A			Up to size 12 inches & 900 ANSI class	
					Control Component India PVT Ltd	Sricity (Andhra Pradesh)		A				
					KOSO India Pvt Ltd	Nasik		A				
					KSB MIL Controls Ltd	Thrissur (Kerala)		A				
					Emerson Process Management Ltd	Chennai		A				
					Flow Serve India Controls Pvt Ltd	Bengaluru		A			Up to size 14 inches & 600 ANSI class	
					Forbes Marshall Arca Pvt Ltd	Pune		A			Up to size 16 inches & 900 ANSI class	

NTPC		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)				LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES								DATE :	
		CONTRACT : 1									
		CONTRACT NO :									
					GE Oil & Gas India Pvt Ltd	Coimbatore	A			Up to size 10 inches & 900 ANSI class /Up to size 24 inches & 600 ANSI class	
					Instrumentation Limited	Palakkad (Kerala)	A			Up to 2500 ANSI class	
					Dresser Produits industriels Industriels S.A.S	France	A				
					CCI	USA / Austria / S.Korea / switzerland	A				
					Nihon Koso Co Ltd	Japan	A				
					Wielend & Tuxhorn	Germany	A				
					SPX Flow Technology	USA/UK	A				
					Emerson (Fisher)	USA/France/Japan	A				
					HORA	Germany	A				
					Sempell AG	Germany	A				
					Leslie Controls Inc	USA	A				
8	Electrical Actuator (With gear box if applicable)										
					Antrieb Technik Pvt Ltd	Chennai	A			For low torque applications only	
					Auma	Bengaluru	A				
					Limitorque	Faridabad	A			Model no L120,SMB,LY series, Gear Box T, HBC Series	
					Rotork	Bengaluru	A			For low torque app (Up to 1000 Nm)	
					Rotork Controls (India) Private Ltd	Chennai	A			For low torque app (Up to 1000 Nm) & High torque 4000 to 7000 Nm With integral starter for non critical applications	
					Auma	Germany	A				
					Limitorque	USA	A				
					Rotork	UK	A			For low torque app (Up to 1000 Nm)	
					Nippon gear	Japan	A				
					Drehmo GMBH	Germany	A			C Matie Series (DMC/DMCR)	
9	Electrical Actuator-Non-Intrusive (With gear box if applicable)										
					Bernard Controls	France	A				
10	Fiber optic cable										
					U M Cables Ltd	Silvassa (Daman)	A				
					KEC International Ltd	Mysore	A				
					Apar Industries Limited	Valsad (Gujrat)	A				
					HFCL	Goa	A				
					Aksh Fibre	Bhiwadi (Raj)	A				
					Finolex Cable Ltd	Goa	A				
					Birla Cable Limited	Rewa	A				
					R&M	Switzerland	A				
					Molex	UK	A				
					Corning	USA	A				
11	Fire Alarm Panel										
					Toshniwal Industrial Pvt Ltd	Ajmer	A			1.M/S Notifier Make Fire alarm Panel 2.PI Refer Note-02	
					Bosch Security system	Bengaluru	A			1.Detector , Hooter, MCP, Modules, Panel shall be M/s Bosch Make	

<div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block;"> NTPC </div>		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)					LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES									DATE :	
		CONTRACT :										
		CONTRACT NO :										
					Notifier	USA	A					
					Autronica	Norway	A					
					Schrack	Austria	A					
					Edwards	Mexico	A					
					Shield Fire safety and security Ltd	UK	A					
					Jhonson Controls	USA	A				Simplex Brand	
12	Flue Gas Analyser (CO)											
					Forbes Marshall Pvt Ltd	Pune	A				For In situ type CO analyser	
					ICE (Asia) Pvt Ltd	Mumbai	A				For In situ type CO analyser 1. CO analyser from Protea UK 2. Other components like, Mounting Flanges, tubing, fittings ,junction boxes, air purging system , calibration cylinders & cables will be supplied by ICE (Asia) Pvt Ltd 3.PI refer Note-2	
					Sick India Pvt Ltd	Mumbai	A				For In Situ Type / CO analyser from SICK AG & Other components like ,Protection tube ,Flanges ,tubing ,fittings ,junction boxes, solenoid valves & calibration cylinders will be supplied by M/S Sick India Pvt Ltd .	
					Emerson Process Management Ltd	Pawane	A				For M/S Emerson Germany/ USA make Analyser	
					Codel	UK	A					
					Land Instruments International	UK	A					
					Sick AG	Germany	A				For In Situ Type	
					Envoirement SA	France	A				For Hot Extractive	
					Fuji Electric	Japan	A					
					Servo max Group	UK	A					
					Siemens	Germany	A					
13	Flue Gas Analyser (CO2)											
					Yokogawa Electric Corporation	Japan	A				IR-400 Series	
					SIEMENS Ltd	China	A					
					Sick AG	Germany	A				Hot Extractive Type	
					Fuji Electric	Japan	A					
					Envoirement SA	France	A				Hot Extractive Type	
14	Flue Gas Analyser (SO2 and Nox)											
					Sick India Pvt Ltd	Mumbai	A				For In Situ Type SO2 analyser 1. Analyser will be from Sick AG Germany 2. Other components like ,Whether proof covers ,flanges ,purge air unit ,junction boxes ,cables ,PC ,remote display ,gas cylinders shall be supplied by M/s Sick India Pvt Ltd	
					Emerson Process Management Ltd	Pawane	A				For M/s Emerson Germany/ USA make Analyser	
					Envoirement SA	France	A				For Hot Extractive	
					Fuji Electric	Japan	A					
					Siemens	Germany	A					
					Yokogawa Electric Corporation	Japan	A				IR-400 Series	
					Servo max Group	UK	A					
					Sick AG	Germany	A				Hot Extractive Type For SO2 & NOx and In situ type for SO2 analyser	
15	Continous Emission Monitoring system											
					Horiba India Pvt Ltd	Pune	A				Approval conditions as per approval letter no - CQA/NTPC Mauda-II / H-321 / M/S Horiba India Pvt Ltd Dated 03.10.2019	


NTPC		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)					LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES									DATE :	
		CONTRACT : -										
		CONTRACT NO :										
					Yokogawa India Ltd	Bengaluru		A			1. SO2,NOx & CO2 Analyser will be from M/S Yokogawa Electric Corporation Japan . 2.Other Conditional as per approval letter no Ref. No.:- CQA/BARH-I / Y-023/ M/s Yokogawa India Ltd dated 21.05.2020	
					Adage Automation Pvt Ltd.	Goa		A			For M/s Siemens Germany make SO2,NOx & CO2 Analysers	
					M/s Thermo Fisher Scientific India Pvt. Ltd	Pune		A			Approved only for Dilution Extractive Technique 1)Analyser (SO2,NOx,CO,CO2,Mercury), sampling probe ,sample handling system ,umbical cord etc to be supplied from M/S Thermo Fisher USA . 2) Other BOI shall be as per LOA approved sources	
					Emerson Process Management India Pvt Ltd	Pawane		A			For M/s Emerson Germany make SO2,NOx & CO2 Analysers other conditions as per approval letter.	
					Analyser Instruments Co Pvt Ltd	Kota		A			Analysers from Fuji Japan & other BOI shall be as per LOA approved sources .	
					Envoirement SA India Pvt Ltd	Navi Mumbai		A			Hot Extractive Type / 1.Multipoint gas Analyzers MIR-9000 for SO2, NOx,CO2 & CO ,Probe ,Nafyon drier & heater for drier will be of M/S Environment SA France make. 2. Other components shall be as per the approval letter ref no CQA/NTPC Telangana/E-335/M/SEnvoirement SA India dated 12.02.2019	
16	Instrument Cables (F,G & T/C Cables)											
					Goyolene Fibers (India) Pvt Ltd	Silvassa		A			F&G Type Cable	
					Temsens Instruments Ind Pvt Ltd	Udaipur		A				
					Havells India	Alwar		A			F Type Cable	
					Paramount Communication Ltd	Khushkhera		A				
					Polycab	Daman		A				
					Delton	Faridabad		A				
					KEI	Bhiwadi (Raj)		A				
					Elkey Telelinks	Faridabad		A				
					CORDS	Kaharani		A				
					CORDS	Bhiwadi		A				
					Nicco	Kolkata		A				
					Universal Cable	Satna		A				
					Thermocables	Hyderabad /Mahboobnagar		A				
					Gupta Power Infrastructure Ltd.	Khurdha		A				
					CMI	Faridabad		A				
					Advance Cables Pvt Ltd	Bengaluru		A			F&G Type Cable	
					Gemsab Industries Ltd	Bhiwadi (Raj)		A			F&G Type Cable	
					Apar Industries Limited	Valsad		A			F&G Type Cable	
					Suyog Electricals Ltd	Halol (Gujrat)		A				
					Special Cables Pvt Ltd	Rudrapur		A				
					T C Communication	Ghaziabad		A				
					TEW & C	USA		A				
					Habia cables	Sweden		A				
					Kerpen cables	Germany		A				
					Lapp cables	Germany		A				
					Thermo elecrtca Bv	Netherland		A				
17	Large Video Screen (LED Based)											
					Pyrotech Electronics Pvt Ltd	Udaipur		A				
					Delta India Electronics Pvt Ltd	Gurugram		A				
					Barco Electronics system (P) Ltd	Noida		A				
					Planner System Inc	USA		A				


<div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block;"> NTPC </div>		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)					LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES									DATE :	
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		CONTRACT NO :										
18	Master Slave Clock System					Signals and Systems Pvt. Ltd. (SANDS)	Chennai	A				
						Masibus	Gandhinagar	A				
						Sertel Electronics Pvt. Ltd.	Chennai	A				
						Hopf Elektronik GmbH	Germany	A				
						Hathway	USA	A				
						Mein Berg	Germany	A				
						Moser Baer AG	Switzerland	A				
19	Mosaic tiles /Console items											
						Pro Plan	Germany	A				
						TEW	Germany	A				
20	PA System (IP Based)											
						BNA Technology Consulting Ltd.	Bengaluru	A				BOI shall be from LOA approved sources.
						Armtel	Russia	A				
						Zenitel	Norway	A				1.PA system active component , Proprietary item will be Zenitel Norway make 2.Other components & BOI shall be from LOA approved sources
						Commend International GMBH	Austria	A				
20A	PA System (IP Based)/System Integrators											note-2
						Willstrong Solutions Pvt. Ltd	Greater Noida	A				For M/s Armtel Russia system Approval conditions as per approval letter no Patratu-QA/9585-001-102/VA-Willstrong Dated: 21.12.20
						Toshniwal Industries Pvt Ltd	Ajmer	A				For M/s Commend Austria make system
						Aishan Technologies Pvt Ltd	Bengaluru	A				For M/s Zenitel Norway make system
						Haritasa Checkmate Electronics Pvt Ltd	Bengaluru	A				For M/s Commend Austria make system
						Netware Computer Pvt Ltd	New Delhi	A				For M/s Commend Austria make system
21	PLC System											
						Emerson Automation solution Intellegent plateforms Pvt Ltd	Bengaluru	A				PLC modules from M/s Emerson USA & BOI shall be from LOA approved sources
						ABB India Ltd	Bengaluru	A				
						Schneider Electric system india Pvt Ltd	Chennai	A				PLC modules from M/s Schneider France & BOI shall be from LOA approved sources
						Rockwell	Sahibabad	A				
						Siemens	Nasik	A				
						Honeywell	Pune	A				PLC modules from M/s Honeywell ,S.Korea & BOI shall be from LOA approved sources
						Schneider Electric India Pvt Ltd	Bengaluru	A				PLC modules from M/s Schneider France & BOI shall be from LOA approved sources
21-A	PLC System Integrators											note-2
						Ladder Automation Solution Pvt Ltd	Gurugram	A				For M/s Honeywell make system
						Virtual Automation	Ranga Reddy (Telangana)	A				For M/s Schneider make system
						Cotmac Electronics Pvt Ltd	Pune	A				For M/s SIEMENS make system
						Tech-Masters	Hyderabad	A				For M/s Emerson make system
						Powertech Switchgear (I) Pvt Ltd	Sonepat	A				For M/s Schneider make system
						Unity Industrial Automation Pvt Ltd	Delhi	A				For M/s Rockwell make system


NTPC		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)					LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES									DATE :	
		CONTRACT :										
		CONTRACT NO :										
					EMCONS	Ranchi	A				For M/s Rockwell make system	
					Divya Engineers	Chennai	A				For M/s SIEMENS make system	
					M D Industries	Vadodara	A				For M/s Emerson make system	
					Velox automation	Surat	A				For M/s SIEMENS make system	
					Vision Comptel	Kolkata	A				For M/s Emerson make system	
					Adaptive Engineering Private Limited	Ahmedabad	A				For M/s Schneider make system	
					Greenwave Solutions Private Limited	Kolkata	A				For M/s Rockwell make system	
					Dreamz Automation	Ghaziabad	A				For M/s SIEMENS make system	
					Creative Robotics	Ghaziabad	A				For M/s Honeywell make system	
					Kruti Techno Engineer Pvt Ltd	Chhapraula (GB Nagar	A				For M/s SIEMENS make system	
					EDS Instruments & Systems Pvt Ltd	Chennai	A				For M/s Honeywell make system	
					Delsys Automation Technologies Pvt Ltd	Chennai	A				For M/s Emerson make system	
					Hindustan Controls and Equipment Ltd	Kolkata	A				For M/s Emerson make system	
					Vollkraft Engineering And Consultant (P) Ltd	Kolkata	A				For M/s Emerson make system	
					SSM Infotech Solutions Pvt Ltd	Surat	A				For M/s Schneider make system	
					Sun Industrial Automation & Solutions	CHENNAI	A				For M/s Schneider make system	
22	Positive displacement flow meter /Transmitter											
					Toshniwal corporation Hyvac	Chennai	A				1.Upto 4 Inches pipe size 2..BOI Like Sensor & pulse to current converter from M/s Bopp & Reuther approved sources 3.Electronics Meter (if Any) is to be procured from M/s Fluidwell Netherland	
					Brooks	USA	A					
					Bopp & Routhier	Germany	A					
					OVAL	Japan	A					
23	Radar type level transmitter											
					Limaco	Russia	A				High Frequency Type	
					Emerson Process Management Ltd	Pawane	A				For M/s Emerson Singapore make	
					Endress & Houser	Aurangabad	A					
					Siemens	Canada	A					
					B M Technology	Italy	A				For Non Contact type	
					Magnetrol	Belgium	A					
					ABB	USA	A				K-Tech Brand	
					Endress & Houser	Germany	A					
					Saab Rosemount	Sweden	A					
					Emerson Process Management	Singapore	A				Rosemount 3300 series for GW Radar & 5600 Series for Non-Contact type	
					Endress & Houser	Germany	A					
					Vega Grieshaber KG	Germany	A					
24	Temp Transmitter											
					Endress & Houser	Aurangabad	A					
					Emerson Process Management Ltd	Pawane	A				For M/s Emerson Singapore make	


NTPC		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)					LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
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		CONTRACT : -										
		CONTRACT NO :										
					Yokogawa	Bengaluru	A				Make Yokogawa japan and calibration at Yokogawa Banglore	
					ABB	Bengaluru	A				For M/s ABB Germany make	
					WIKA Instruments India Pvt Ltd	Pune	A				For M/s WIKA Germany make Model no T-32	
					Honeywell Automation India Ltd	Pune	A					
					Yokogawa	Japan	A					
					Moore	USA	A					
					M System co Ltd	Japan	A				Model No-B3HU-0	
					Emerson	U.S.A/Singapore / Germany	A					
					ABB	Germany	A					
					Emerson Process Management	Germany	A					
25	Terminal Block (Cage and Clamp type)											
					Connectwell	Dombivali	A					
					Elmex	Vadodara	A					
					Phoenix	Germany / India	A					
					Weidmuller	Germany	A					
					Wago	Germany / India	A					
26	Electronics Transmitter (Pressure , DP and DP based Flow/Level)											
					ABB Ltd	Bengaluru	A				2600T & critical item from ABB Italy/ Their approved source;	
					Emerson Process Management Ltd	Pawane	A					
					Siemens Ltd	Thane	A				Model:-SITRANS P	
					Honeywell Automation India Ltd	Pune	A					
					Baldota Control and Equipment Pvt Ltd	Navi Mumbai	A				PT & DPT of LD 301 Series (SMAR)	
					Yokogawa India Limited	Bengaluru	A				EJA-E 110,430,530 SERIES & all raw material and BOI under knocked down condotion (sensor assembly as a single unit) shall be sourced from M/S Yokogawa Japan	
					M/s Endress + Hauser India Automation Instrument Pvt Ltd	Aurangabad	A					
					Emerson (Rosemount)	USA	A					
					Yokogawa	Japan	A					
					ABB	Germany / Italy	A				2600T & critical item from ABB Italy/ Their approved source;	
					Siemens	France	A				Sitrans P DSIII Series	
					Fuji Electric	France	A				FCX -AIII SERIES	
					Fuji	Japan	A					
27	Ultrasonic Type Flow Meter (for Stack)											
					Sick India Pvt Ltd	Mumbai	A					
					SICK AG	Germany	A					
					Durag	Germany	A					
					Teledyne	USA	A					
28	Ultrasonic type Flow Transmitter											
					GE Sensing EMES	Ireland	A				Ultrasonic series -UTX878,AT868 & DF868 .Shall be supplied through GE Sensing Banglore	
29	UPS With ACDB											
					Vertive Energy Pvt Ltd	Pune	A				Upto 125 KVA for 1 phase and 300 KVA for 3 Phase	
					Vertive Energy Pvt Ltd	Mumbai	A				Upto 160 KVA	
					Hitachi Hirel Power Electronics Pvt Ltd	Gandhinagar	A				Upto 160 KVA,	

NTPC		PROJECT :ANDAMAN & NICOBAR GAS POWER PROJECT (50 MW)				LIST OF C&I ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL FOR C&I ITEMS				REVISION NO : 00	
		PACKAGE : EPC PACKAGES								DATE :	
		CONTRACT : -									
		CONTRACT NO :									
					Fuji Electric Consul Neowatt Private Limited	Pune	A			Up to 100 KVA single phase	
					KELTRON	Trivendrum	A				
					Merlin & Gerin	France	A				
					Gutor	Switzerland	A				
					AEG	Germany	A				
					Fuji Electric	Japan	A				
LEGENDS :											
1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY											
A - For those items proposed vendor is acceptable to Customer. To be indicated with letter "A" in the list along with the condition of approval, if any.											
NOTE - 1 : Approval is conditional and subject to Sub QR / Provennes clearance as specified in the contract specification. Further for any change in the Technical specification at later stage vendor approval will be reviewed accordingly.											
NOTE-2 - Major Bought-Out-Items are to be procured from LOA approved sources & the same shall be finalized during the finalization of Manufacturing Quality Plan . MQP shall be duly vetted by OEM with their project specific authorisation letter .											

	PROJECT: A&N GAS PROJECT 50MW	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL			DOC NO	
	PACKAGE: EPC PACKAGE				REV. NO.	
	Main supplier:	SUB SYSTEM: CIVIL WORKS			DATE	
	Contract No.:					
SL. NO.	ITEM	QAP / INSP. CAT	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
1.	GALVANIZED STEEL STRUCTURES (LATTICE & PIPE) FOR SWITCHYARD AND TRANSMISION LINE	I	VIJAY TRANSMISSION LTD	RAIPUR	A	
			UNITECH POWER TRANSMISSION LTD	NAGPUR	A	
			ASSOCIATED POWER STRUCTURES	VADODARA	A	
			R.S. INFRAPROJECTS PVT. LTD	SURAJPUR	A	
			NEW MODERN TECHNOMECH	MAYURBHANJ (ORRISA)	A	
			GOOD LUCK STEEL TUBES	SIKANDRABAD	A	
			UNIQUE STRUCTURES & TOWERS LTD.	RAIPUR	A	
			VATCO ELEC-POWER PVT. LTD.	NAVIMUMBAI	A	GALVANISING AT SIGMA GALVANISER NAVI MUMBAI
			R.S. INFRAPROJECTS PVT. LTD	SIKANDRABAD	A	
			ADVANCE STEEL TUBE	SAHIBABAD	A	
			SANGAM STRUCTURES LTD.	ALLAHABAD	A	
			RELIABLE SPONGE PVT LTD UNIT III	KALUNGA	A	
			VSP ENTERPRISES PVT. LTD	SONEPAT	A	
SKIPPER LIMITED	UNIT-I: JANGALPUR, Howrah. Unit-II: ULUBERIA UNIT, Howrah. UNIT- III: BCTL, Howrah.	A	Proto type inspection at Unit- Bagnan, Howrah			

	PROJECT: A&N GAS PROJECT 50MW	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL			DOC NO	
	PACKAGE: EPC PACKAGE				REV. NO.	
	Main supplier:	SUB SYSTEM: CIVIL WORKS			DATE	
	Contract No.:					
SL. NO.	ITEM	QAP / INSP. CAT	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
			RUKMANI ELECTRICAL & COMPONENT PVT. LTD ENCORP POWERTRANS PVT LTD RICHARDSON & CRUDDAS (1972) LTD	RAIPUR PALGHAR NAGPUR	A A A	
2.	COLOUR COATED METAL DECK & CLADDING/ROOFING SHEET (COIL)	I	TATA STEEL LIMITED TATA STEEL LIMITED TATA BLUESCOPE STEEL LTD ARCELORMITTAL NIPPON STEEL INDIA LIMITED NATIONAL STEEL & AGRO INDUSTRIES LTD JSW STEEL COATED PRODUCTS LTD JSW STEEL COATED PRODUCTS LTD BHUSHAN POWER & STEEL LTD	KHOPOLI, RAIGARH SAHIBABAD JAMSHEDPUR PUNE DHAR KALMESHWAR (NAGPUR) TARAPUR, BOISAR SAMBALPUR (ODISHA)	A A A A A A A	AL-ZN COIL FOR CLADDING
3.	ELECTROFORGED GRATING	II	INDIANA GRATINGS PVT. LTD KANADE ANAND UDYOG PREMIER POWER PRODUCTS LTD BHOLA RAM STEEL PVT. LTD PINAX STEEL INDUSTRIES PVT LTD	PUNE THANE HOWRAH PATNA PATNA	A A A A A	

	PROJECT: A&N GAS PROJECT 50MW	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL			DOC NO	
	PACKAGE: EPC PACKAGE				REV. NO.	
	Main supplier:	SUB SYSTEM: CIVIL WORKS			DATE	
	Contract No.:					
SL. NO.	ITEM	QAP / INSP. CAT	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
			ANKIT ELECTROGRATING	RAIPUR	A	
			FERROTECH STRUCTURALS (INDIA) PRIVATE LIMITED.	PUNE	A	
			RATAN PROJECTS & ENGINEERING CO. PVT. LTD.	HOWRAH	A	
			VINFAB ENGINEERS INDIA PVT LTD. (For Galvanising) VINFAB GRATINGS (For Fabrication)	THANE	A	
4.	PROFILERS FOR COLOUR COATED METAL DECK & CLADDING/ROOFING SHEETS	II	MAIN CONTRACTOR APPROVED SOURCE	-	-	
5.	STOP LOG GATES, TRASH RACK AND LIFTING BEAM	II	MAIN CONTRACTOR APPROVED SOURCE	-	-	
6.	HIGH PERFORMANCE MOISTURE COMPATIBLE CORROSION RESISTANT COATING SYSTEM	III	CECRI LICENSED SOURCES	-	-	
7.	BITUMEN	III	ALL GOVERNMENT REFINARIES	-	-	
8.	PTFE BEARING / ELASTOMERIC BEARING	III	MORTH / RDSO APPROVED VENDORS	-	-	
9.	CEMENT	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
10.	CI PIPES	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
11.	RCC PIPES	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
12.	CPVC/UPVC PIPES	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
13.	PVC WATER STOP	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
14.	POLYTHENE WATER STORAGE TANKS	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
15.	CERAMIC / VITRIFIED TILES	III	BIS APPROVED SOURCES HAVING	-	-	

	PROJECT: A&N GAS PROJECT 50MW	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL			DOC NO	
	PACKAGE: EPC PACKAGE				REV. NO.	
	Main supplier:	SUB SYSTEM: CIVIL WORKS			DATE	
	Contract No.:					
SL. NO.	ITEM	QAP / INSP. CAT	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
			VALID BIS LICENCE			
16.	PARTICLE BOARDS, PLYWOOD, MDF	III	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
17.	FIRE PROOF DOORS	III	MAIN CONTRACTOR APPROVED SOURCES WITH VALID PROTOTYPE TEST REPORT FROM CBRI/CPRI/GOV. LAB.)	-	-	
18.	CONSTRUCTION CHEMICALS/ADMIXTURE, WATER PROOFING COMPOUNDS AND GROUTS	III	MAIN CONTRACTOR APPROVED SOURCE	-	-	
19.	PAINT AND PAINTING SYSTEM	III	MAIN CONTRACTOR APPROVED SOURCE	-	-	
20.	HIGH SOLID CONTENT LIQUID APPLIED URETHANE BASED ELASTOMERIC MEMBRANE FOR WATER PROOFING	III	MAIN CONTRACTOR APPROVED SOURCE	-	-	
21.	FOUNDATION BOLTS	III	MAIN CONTRACTOR APPROVED SOURCE	-	-	

LEGENDS:

1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter “A” in the list along with the condition of approval, if any.

DR – For these items “Details required” for NTPC review. To be identified with letter “DR” in the list.

2. QP/INSPN CATEGORY:

CAT-I: For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II: For these items the Quality Plans approved by NTPC. However, no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved quality plan.

CAT-III: For these items the Quality control to be exercised as per Main Contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of conformance (COC) by Main Contractor.

UNITS/ WORKS: Place of manufacturing Place of Main Supplier of multi units/works.

NOTE 1: For the items placed in CAT-III for Civil Works, the review and final acceptance shall be done by NTPC-EIC/ FQA on the basis of MTC / certificate of conformance in line with Technical Specifications/FQP.

NOTE 2: Items for which Sub-QR is envisaged, vendors shall be considered for assessment subject to Sub-QR clearance from NTPC Engg.

NTPC VIDYUT VYAPAR NIGAM LIMITED

(A wholly owned Subsidiary of NTPC Limited)



SECTION - VII

BOOK 1 OF 3

FORMS AND PROCEDURES

FOR

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO.: NVVN / C&M / RE-333 / 2024-25

(This document is meant for the exclusive purpose of bidding against this Bid Document No. / Specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

TABLE OF FORMS AND PROCEDURES

SI.No.	Description
1a.	<u>Section-VII (Part 1 of 3)</u> Techno-Commercial Bid (Envelope-I) Bid Form & Attachments
1b.	<u>Section-VII (Part 2 of 3)</u> Price Bid (Envelope –II) Bid Form & Attachments along with Price Schedules
	<u>Section-VII (Part 3 of 3)</u>
2.	Bid Security
3(a)	Form of Notification by the Employer to the Bidder
3(b)	Form of Sight Draft
4.	Forms of Notification of Award
5.	Form of Contract Agreement
6.	Performance Security Form
6a	Performance Security Form in case of Contract awarded to Joint Venture- (NOT APPLICABLE)
7(i)	Bank Guarantee Form for Advance Payment (for Supply CIF/Ex-Works)
7(ii)	Bank Guarantee Form for Advance Payment (for Installation Services)
7(iii)	Bank Guarantee Form for Advance Payment in case of Contract awarded to Joint Venture- (NOT APPLICABLE)
8.	Form of Completion Certificate
9.	Form of Operational Acceptance Certificate
10.	Form of Trust Receipt
11.	Forms of Indemnity Bond (2 Nos.)
12.	Form of Authorization Letter
13.	Form of Deed of Joint Undertaking – NOT APPLICABLE
14.	Form of Bank Guarantee by Associate/Collaborator - NOT APPLICABLE
15.	Form of Joint Venture Agreement –(NOT APPLICABLE)
16.	Form of Bank Guarantee Verification Check Lists

17. Form of Extension of Bank Guarantee
18. Form of Indemnity Bond for Removal/Disposal of Surplus Material
19. Form of Contract Closing certificates

(BIDDER MAY TAKE NOTE OF THE FOLLOWING POINTS WHILE SUBMITTING ITS BID)

- Bidders are required to furnish requisite details in the formats specified in the bidding documents for meeting the stipulated qualifying requirements (QR) along with all supporting documents like copies of client's certificates, work order and contract agreements etc. If any of the reference works furnished by bidder pertains to the contract(s)/ works executed by bidder for NTPC/NVVN in the past then in respect of such contract(s)/ works, bidder is not required to enclose client's certificate(s) along with its bid
- In case of extension of techno-commercial bid opening date, bidder to furnish audited annual reports along with its bid as per extended date of techno-commercial bid opening to meet the stipulated financial QR criteria.
- Power of attorney duly notarized by a notary public indicating that the person(s) signing the bid has/have the authority to sign the bid and the bid is binding upon the bidder during the full period of its validity backed by a copy of board resolution/ other relevant documents to demonstrate the authority of the person issuing the power of attorney. To be furnished along with the bid.
- Power of attorney to the authorized signatory of the bidder for signing of bid, wherever applicable, to be submitted along with bid and should be dated not later than the date of signing the bid.
- Bidder to ensure that bid security/integrity pact to be submitted in original strictly as per specified formats duly signed in original by authorized signatory and stamped on each page. Scanned/ photocopy of these documents without signature in original shall not be acceptable and shall be summarily rejected.
- Date of purchase of stamp paper of instruments like bid security etc should be on or before the date of execution of such instruments.
- Bidders To Submit This Techno-Commercial Bid Form Along With All Attachments In Pdf Format And No Physical Signatures Are Required Since Bid Shall Be Digitally Signed By The Bidder.

1A. BID FORM AND ATTACHMENTS
(TECHNO-COMMERCIAL BID)

TECHNO-COMMERCIAL BID FORM

Ref No.:

Date:

**Name of Package : ANDAMAN AND NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN / C&M / RE-333 / 2024-25**

To
NTPC VIDYUT VYAPAR NIGAM LIMITED
5^h Floor, Engineering Office Complex, Plot
A-8A, Sector 24, Noida-201301,
Distt. Gautam Budh Nagar, State of U.P., India

Gentlemen and/or Ladies,

1.0 Having examined the Bidding Documents No. NVVN/C&M/RE-333/2024-25, including its subsequent amendmentsand clarifications....., if any (insert Numbers), the receipt of which is hereby acknowledged, we the undersigned, offer to design, manufacture, test, deliver, construct, install and commission (including carrying out Guarantee Test) the facilities under the above-named Package in full conformity with the said Bidding Documents and hereby furnish our Techno-Commercial Bid.

1.1 We have read the ITB clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries. We certify that we/our Collaborator/JV Partner/Consortium member are/is not from such a country or, if from such a country, have/has been registered with the Competent Authority and we will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority.

*Further, we certify that we do not have any Transfer of Technology (TOT) arrangement requiring registration with the competent authority.

Or

*Further, we certify that we have valid registration for Transfer of Technology (TOT) arrangement with the competent authority to participate in this procurement.

We hereby certify that we fulfill all requirements in this regard and are eligible to be considered.

*We further confirm that evidence of valid registration by the Competent Authority for us/our Collaborator/JV Partner/Consortium member, as applicable, is enclosed as Annexure...**.... to Bid.

*Bidder to strike-off, if not applicable.

**Bidder to mention the Annexure no.

2.0 COMPLIANCE TO THE PROVISIONS OF THE BIDDING DOCUMENTS

2.1 We have read all the provisions of the Bidding Documents and confirm that

notwithstanding anything stated elsewhere in our bid to the contrary, the provisions of the Bidding Documents, are acceptable to us and we further confirm that we have not taken any deviation to the provisions of the Bidding Documents anywhere in our bid.

Any deviation, variation or additional condition etc. or any mention, contrary to the provisions of Bidding Documents and its subsequent Amendment(s)/ Clarification(s)/Addenda/Errata (if any) found anywhere in our bid proposal, implicit or explicit shall stand unconditionally withdrawn, without any cost implication whatsoever to the Employer, failing which our bid shall be rejected and our Bid Security shall be forfeited.

- 2.2 We further declare that additional conditions, variations, deviations, if any, found anywhere in the proposal, shall not be given effect to.
- 3.0 We undertake, if our bid is accepted, to commence work on the Facilities immediately upon your Notification of Award to us and to achieve Completion of Facilities and conduct Guarantee Tests within the time specified in the Bidding Documents.
- 4.0 We undertake, if our bid is accepted, to first, commence work on establishing base in India for manufacturing of Supercritical Steam Generator Set and Supercritical Steam Turbine Generator Set and second, to transfer technology for manufacturing Supercritical Steam Generator Set and Supercritical Steam Turbine Generator Set from Technology provider(s) to Indian Manufacturing Company(ies) in line with QR Clause. **An undertaking in this regard supported by Board Resolution of our and/or our Associate's (as applicable) company for manufacturing of Supercritical Steam Generator Sets and Super Critical Steam Turbine Generator Sets is enclosed at Attachment-15 of this Bid Form.**
- 5.0 If our bid is accepted, we undertake to provide Advance Payment Security, Contract Performance Security, Performance Security for Phased Manufacturing Program and Securities for Deed(s) of Joint Undertaking (as applicable) in the forms and amounts and within the time specified in the Bidding Documents.
- 6.0 Until a formal Contract is prepared and executed between us, this bid, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.
- 7.0 We understand that you are not bound to accept the lowest or any other bid you may receive.
- 8.0 We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal, is in all respects for and in good faith, without collusion or fraud.
- 9.0 We have read the provisions of "Preference to Make in India and granting of purchase preference to local suppliers" enclosed with the Bid Data Sheets. In terms of the requirement of the aforesaid provisions, we hereby declare the following:
- (i) In order to avail purchase preference, we confirm that we are a 'Class-I local Supplier'

as per details given below:

Sl. no.	Description of Goods & Services	Details of the location(s) at which the local value addition is made

OR

(i) We confirm that we are not a 'Class-I local Supplier'

*Bidder to Strike off, whichever is not applicable.

Bidder may also enclose additional sheets in similar format (if required), for providing details pertaining to local value addition.

(ii) We confirm that we fulfill the requirements of Local content for Class-I local supplier for Item(s) mentioned at clause no. 40.00.00 of GTR in Technical Specifications, as applicable. We further confirm that in case such item(s) are bought-out for us, we shall source the same from Class-I local supplier only.

We undertake that a certificate from the statutory auditor or cost auditor (in the case the bidder is a company) or from a practicing cost accountant or practicing chartered accountant (in respect of bidders other than companies) certifying the percentage of local content shall be submitted by us prior to submission of our last bill for payment.

We further confirm that we are presently not debarred / banned by any other procuring entity for violation of 'Public Procurement (Preference to Make in India), Order 2017' (PPP-MII Order) dated 15.06.2017 and its subsequent revisions / amendments issued by Department for Promotion of Industry and Internal Trade (DPIIT).

(In case a Bidder has been banned/debarred by any other procuring entity for violation of 'Public Procurement (Preference to Make In India), Order 2017' (PPP- MII Order) dated 15.06.2017 and its subsequent revisions / amendments issued by Department for Promotion of Industry and Internal Trade (DPIIT), the same may be declared by Bidder by striking off para above and declaring the details of banning using additional sheets.)

10.0

We further confirm that we have quoted the local content portion of our bid price in Indian Rupees only. We undertake that the certification from the statutory auditor or cost auditor (in the case the bidder is a company) or from a practicing cost accountant or practicing chartered accountant (in respect of bidders other than companies) in this regard shall be submitted by us prior to submission of our last bill for payment.

Dated this.....day of. 20.....

Thanking you, we remain,

Yours faithfully,

Date : (Signature).....
Place : (Printed Name).....
(Designation).....
(Common Seal).....

Business Address:

Country of Incorporation (Province also to be indicated):

Fax No. :

Phone No. :

Email ID :

Note: 1. Bidders may note that no prescribed proforma has been enclosed for:

- (a) Attachment 2 (Power of Attorney)
- (b) Attachment 4, (For documentary evidence establishing that the facilities offered are eligible facility and conform to bidding documents.)

For Attachments 2 and 4, Bidders may use their own proforma for furnishing the required information with the Bid.

**ANDAMAN AND NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN / C&M / RE-333 / 2024-25**

BID SECURITY

**BIDDER TO FURNISH BID SECURITY IN LINE WITH ITB
CLAUSE 12.0 AND AS PER FORMAT GIVEN AT SL. NO.
2 OF SECTION VII (FORMS & PROCEDURES)**

**ANDAMAN AND NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN / C&M / RE-333 / 2024-25**

TENDER FEE

**BIDDER TO FURNISH TENDER FEE
IN LINE WITH
ITB CLAUSE 8.0**

**ANDAMAN AND NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN / C&M / RE-333 / 2024-25**

POWER OF ATTORNEY

BIDDER TO ATTACH THE POWER OF ATTORNEY INDICATING THAT THE PERSON(S) SIGNING THE BID HAS/HAVE THE AUTHORITY TO SIGN BOTH THE BID [TECHNO-COMMERCIAL BID AND PRICE BID] AND THAT THE BID IS BINDING UPON THE BIDDER DURING THE FULL PERIOD OF ITS VALIDITY IN ACCORDANCE WITH ITB CLAUSE 13

**ANDAMAN AND NICOBAR GAS POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN / C&M / RE-123 / 2021-22
(Qualification Data)**

Dear Sirs,

We seek qualification under Clause 8.1.2(a) of Section ITB and Item No. 6.0 of IFB and our qualification data in support thereof is enclosed in the following Attachments:

- | | | | |
|-----|---------------|---|---|
| 1. | Attachment 3A | : | Experience Details of Bidder AND their Associate / Collaborator (if applicable). Bidder to use the relevant Attachment as applicable. |
| 2. | Attachment 3B | : | Details of Financial Capacity Status |
| 3. | Attachment 3C | : | Details of manufacturing and testing Capabilities |
| 4. | Attachment 3D | : | Details of manufacturing capacities & Plant Loading |
| 5. | Attachment 3E | : | Present order book position |
| 6. | Attachment 3F | : | Past Performance Data |
| 7. | Attachment 3G | : | Data regarding Key Construction Personnel |
| 8. | Attachment 3H | : | Manpower Loading Data |
| 9. | Attachment 3I | : | Letter of undertaking to ensure successful performance of Gas Engine |
| 10. | Attachment 3J | : | Brief write up regarding Project Management |
| 11. | Attachment 3K | : | Details pertaining to Proveneness criteria |

We further understand and agree that any misleading or false information furnished by us may result in summary rejection of our bid.

- Note :** 1. The Bidder shall enclose relevant documents like copies of authentic purchase order, completion certificates, agreements etc. supporting the details/data provided in Attachments - 3A to 3K.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50

MW) BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

(Qualification Data to be filled in by bidders who are seeking qualification as per item No. 6.1.0 of Invitation for Bid)

Bidder's Name & Address:

To,

Sr. Manager (C&M)
 NTPC VIDYUT VYAPAR LIMITED
 5th Floor, Engineering Office Complex, Plot A-8A, Sector 24, Noida-201301

1.0 We, M/s. **{Engine Manufacturer}**, the Bidder are seeking Qualification as per clause 6.1.0 of IFB.

2.0 We confirm that we meet the qualifying requirements specified in Item No. 6.1.0 of IFB Section-I of Bidding Documents. In this regard, we declare that we are a Engine manufacturer and has designed, manufactured, supplied and commissioned/ supervised commissioning of at least one (01) Gas Engine for power generation, having minimum rating as that of the offered Gas Engine, and has logged a minimum of 4000 fired hours since commissioning and have been in successful operation, for a period of at least one (01) year, prior to the date of techno-commercial bid opening, the details of which are given below. Further we meet the requirements stipulated above as *singularly/ collectively along with its Subsidiaries (held directly or indirectly)/ Holding Company (*strike out whichever is not applicable). In case we are meeting the requirements collectively along with its subsidiaries)/ Holding Company, we, along with techno-commercial bid, shall furnish a letter jointly signed by us and the Holding Company/ all its Subsidiary (ies) extending support to us for successful performance of the Contract, as per the format enclosed in the bidding documents, failing which we shall be disqualified, and our bid shall be rejected.

S.No	Item Description	Details	Supporting documents for details furnished
(1)	(2)	(3)	(4)
i.	Name, address, e-mail, Tel. No. and Fax No. of the Bidder		
ii.	Name and Designation of the responsible person		
iii.	Name of the reference stations and its location		
iv.	Name of the client / owner with full address, phone, fax & e-mail		

- v. Rating of Gas Engine
- vi. Purpose for which Gas Engine Installed i.e. Power generation/other
- vii. Logged fired hours since Commissioning
- viii. Date of commissioning of Gas Engine
 - (a) date from which the system is in successful operation condition
 - (b) Duration of successful operation prior to the date of techno-commercial bid opening
- ix. Whether Bidder's scope of work includes
 - (i) Design *Yes/*No
 - (ii) Manufacturing *Yes/*No
 - (iii) Supply *Yes/*No
 - (iv) *Commissioning/ *Supervised Commissioning *Yes/*No
- x. (i) Name of Holding Company
(In case the requirement mentioned above, is met collectively)
 - (ii) Name of Subsidiaries:-
(In case the requirement mentioned above, is met collectively)
- xi. (i) Scope of Holding Company
(In case the requirement mentioned above, is met collectively)
 - (ii) Scope of Subsidiaries:-
(In case the requirement mentioned above, is met collectively)

***Strike out whichever is not applicable. Note:**

1. Bidder may use similar format for furnishing, separately, qualification data for a maximum of three (3) times the reference plants, as per provisions of Clause no. 4.0 of Section-III (BDS).
2. Copies of Order / Letter of Award/Contract Agreement/Client Certificate and Performance Certificate from the clients, etc. are to be enclosed clearly establishing the scope of work/ years of successful operation, etc. in support of meeting the Qualifying Requirements.
3. Continuation sheets of like size and format may be used if the bidder wishes to provide further two (2) Nos. additional reference plants as per BDS Item No. 4.0.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW) BIDDING
DOCUMENT NO. NVVNC&M/RE-333/2024-25**

**(Qualification Data to be filled in by bidders who are seeking qualification as
per item No. 6.2.0 of Invitation For Bid)**

Bidder's Name & Address:

To,

Sr. Manager (C&M)
NTPC VIDYUT VYAPAR LIMITED
5th Floor, Engineering Office Complex,
Plot A-8A, Sector 24, Noida-201301

1.0 We, M/s. _____, the Bidder are seeking Qualification as per clause 6.2.0 of IFB.

2.0 We meet the qualifying requirements specified in Item No. 6.2.0(i) of IFB, Section-I of Bidding Documents. In this regard, we confirm that we have executed in last 10 years contracts involving engineering, supply, erection/supervision of erection, commissioning/supervision of commissioning, in the area of power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry with the total value of such contracts being INR 1000 million or more. At least one of such contracts have a contract value of INR 300 million or more. These projects have been in successful operation for a period of not less than one (01) year prior to the date of techno-commercial bid opening, the details of which are given below. Further we meet the requirements stipulated above as *singularly/ collectively along with its Subsidiaries (held directly or indirectly)/ Holding Company (*strike out whichever is not applicable). In case we are meeting the requirements collectively along with its subsidiaries)/ Holding Company, we, along with techno-commercial bid, shall furnish a letter jointly signed by us and the Holding Company/ all its Subsidiary (ies) extending support to us for successful performance of the Contract, as per the format enclosed in the bidding documents, failing which we shall be disqualified, and our bid shall be rejected.

S.No. Item Description Details Supporting documents for details furnished under column (3)

(1) (2) (3) (4)

- i. Name of the reference contracts/works and its location
- ii. Name of the client / owner with full address, phone, fax & e-mail
- iii. The value of such contracts

iv. Details of type of industry/area of execution of contract. (Whether power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry)

v. Date of commissioning of such projects

(a) date from which the project have been in successful operation

(b) Duration of successful operation prior to the date of techno- commercial bid opening

vi. Whether Bidder's scope of work includes

(i) Engineering

*Yes/*No

(ii) Supply

*Yes/*No

(iii) Erection/Supervision of erection

*Yes/*No

(iv) Commissioning/ *Supervision of Commissioning

*Yes/*No

vii. (i) Name of Holding Company

(In case the requirement mentioned above, is met collectively)

(ii) Name of Subsidiaries:-

(In case the requirement mentioned above, is met collectively)

viii. (i) Scope of Holding Company

(In case the requirement mentioned above, is met collectively)

(ii) Scope of Subsidiaries:-

(In case the requirement mentioned above, is met collectively)

3.0 Further the details of contract value of INR 300 million or more meeting the requirement of 6.2.0(i) of IFB, Section-I of Bidding Documents The project has been in successful operation for a period of not less than one (01) year prior to the date of techno-commercial bid opening, the details of which are given below:

S.No. Item Description Details Supporting documents for details furnished under column (3)

(1) (2)

(3)

(4)

i. Name of the reference contracts/works and its location

- ii. Name of the client / owner with full address, phone, fax & e-mail
- iii. The value of contract
- iv. Details of type of industry/area of execution of contract. (whether power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry)
- v. Date of commissioning of such projects

- (c) date from which the project is in successful operation condition
- (d) Duration of successful operation prior to the date of techno-commercial bid opening
- vi. Whether Bidder's scope of work includes

- | | |
|---|----------|
| (i) Engineering | *Yes/*No |
| (ii) Supply | *Yes/*No |
| (iii) Erection/Supervision of erection | *Yes/*No |
| (iv) Commissioning/ *Supervision of Commissioning | *Yes/*No |

- vii. (i) Name of Holding Company
(In case the requirement mentioned above, is met collectively)
- (ii) Name of Subsidiaries:-
(In case the requirement mentioned above, is met collectively)
- viii. (i) Scope of Holding Company
(In case the requirement mentioned above, is met collectively)
- (ii) Scope of Subsidiaries:-
(In case the requirement mentioned above, is met collectively)

4.0 In line with the qualifying requirements specified in Item No. 6.2.0(ii) of IFB, Section-I of Bidding Documents, we have associated with M/s..... **(Name of Associate)** who shall also be the supplier of the Gas Engines for this contract whose address is..... **(Address of Associate)** (who meets the requirement of clause 6.1.0 of IFB, the details of which are given below. Further the associate meets the requirements stipulated above as *singularly/ collectively along with its Subsidiaries (held directly or indirectly)/ Holding

Company (*strike out whichever is not applicable). In case we are meeting the requirements collectively along with its subsidiaries)/ Holding Company, we, along with techno-commercial bid, shall furnish a letter jointly signed by us and the Holding Company/ all its Subsidiary (ies) extending support to us for successful performance of the Contract, as per the format enclosed in the bidding documents, failing which we shall be disqualified and our bid shall be rejected.

S.No	Item Description	Details	Supporting documents for details furnished under
	column (3)		

(2)	(2)	(3)	(4)
------------	------------	------------	------------

- | | | | |
|-------|---|--|----------|
| i. | Name, address, e-mail, Tel. No. and Fax No. of the Bidder | | |
| ii. | Name and Designation of the responsible person | | |
| iii. | Name of the reference stations and its location | | |
| iv. | Name of the client / owner with full address, phone, fax & e-mail | | |
| v. | Rating of Gas Engine | | |
| vi. | Purpose for which Gas Engine Installed i.e. Power generation/other | | |
| vii. | Logged fired hours since Commissioning | | |
| viii. | Date of commissioning of Gas Engine
(a) date from which the system is in successful operation condition
(b) Duration of successful operation prior to the date of techno-commercial bid opening | | |
| ix. | Whether Bidder's scope of work includes | | |
| | (v) Design | | *Yes/*No |
| | (vi) Manufacturing | | *Yes/*No |
| | (vii) Supply | | *Yes/*No |

(viii) *Commissioning/ *Supervised
Commissioning *Yes/*No

- x. (i) Name of Holding Company
(In case the requirement mentioned above, is met collectively)
- (ii) Name of Subsidiaries:-
(In case the requirement mentioned above, is met collectively)
- xi. (i) Scope of Holding Company
(In case the requirement mentioned above, is met collectively)
- (ii) Scope of Subsidiaries:-
(In case the requirement mentioned above, is met collectively)

*Strike out whichever is not applicable.

Note:

1. Bidder may use similar format for furnishing, separately, qualification data for a maximum of three (3) times the reference plants, as per provisions of Clause no. 4.0 of Section-III (BDS).
2. The word “executed” in Clause 2.0(i) & Clause 3.0(i) means the Bidder should have:
 - i. in case of Project(s), commissioned the project(s), even if the contract has been started earlier and / or is not completed / closed.
 - ii. in case of Contract(s), completed the scope of work under the contract(s), even if the contract has been started earlier and / or is not closed.
3. Copies of Order / Letter of Award/Contract Agreement/Client Certificate and Performance Certificate from the clients, etc. are to be enclosed clearly establishing the scope of work/ years of successful operation, etc. in support of meeting the Qualifying Requirements.
4. Continuation sheets of like size and format may be used if the bidder wishes to provide further two (2) Nos. additional reference plants as per BDS.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)**BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25**

(Qualification Data to be filled in by bidders who are seeking qualification as per item No. 6.3.0 of Invitation for Bid)

Bidder's Name & Address:

To, Sr. Manager (C&M)
NTPC VIDYUT VYAPAR LIMITED
5th Floor, Engineering Office Complex,
Plot A-8A, Sector 24, Noida-201301

1.0 We, M/s. _____, the Bidder are seeking Qualification as per clause 6.3.0 of IFB.

2.0 Further, In line with the qualifying requirements specified in Item No. 6.3.0(i) of IFB, Section-I of Bidding Documents, our Holding Company M/s..... **(Name of Holding Company)** the supplier of Gas Engines for this contract. whose address is..... **(Address of Holding Company)** (who meets the requirement of clause 6.1.0 of BDS, the details of which are given below:

S.No	Item Description	Details	Supporting documents for details furnished
-------------	-------------------------	----------------	---

(1)	(2)	(3)	(4)
------------	------------	------------	------------

- | | | | |
|------|--|--|--|
| i. | Name, address, e-mail, Tel. No. and Fax No. of the Bidder | | |
| ii. | Name and Designation of the responsible person | | |
| iii. | Name of the reference stations and its location | | |
| iv. | Name of the client / owner with full address, phone, fax & e-mail | | |
| v. | Rating of Gas Engine | | |
| vi. | Purpose for which Gas Engine Installed i.e. Power generation/other | | |
| vii. | Logged fired hours since | | |

Commissioning

- viii. Date of commissioning of Gas Engine
 - (c) date from which the system is in successful operation condition
 - (d) Duration of successful operation prior to the date of techno-commercial bid opening

- ix. Whether Bidder's scope of work includes
 - (ix) Design *Yes/*No
 - (x) Manufacturing *Yes/*No
 - (xi) Supply *Yes/*No
 - (xii) *Commissioning/ *Supervised Commissioning *Yes/*No

*Strike out whichever is not applicable.

3.0 Further we meet the qualifying requirements specified in Item No. 6.3.0(i) of IFB, Section-I of Bidding Documents. In this regard, we confirm that we the bidder have executed/be executing in last 10 years contracts involving engineering, supply, erection/supervision of erection, commissioning/supervision of commissioning, in the area of power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry with the total value of such contracts being INR 1000 million or more, the details of which are given below:

	S.No.	Item Description	Details	Supporting documents for details furnished under column (3)	
	(1)	(2)	(3)	(4)	
	i.	Name of the reference contracts/works and its location			
	ii.	Name of the client / owner with full address, phone, fax & e-mail			
	iii.	The value of such contracts			
	iv.	Details of type of industry/area of execution of contract. (whether power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry)			
	v.	Date of commissioning of such projects			

date from which the project
is in successful operation condition

vi. Whether Bidder's scope of work includes

- | | | |
|-------|--|----------|
| | | *Yes/*No |
| (i) | Engineering | |
| (ii) | Supply | *Yes/*No |
| (iii) | Erection/Supervision of erection | *Yes/*No |
| (iv) | Commissioning/ *Supervision of Commissioning | *Yes/*No |

4.0 Further we confirm that we have executed/be executing in last 10 years contracts involving engineering, supply, erection/supervision of erection, commissioning/supervision of commissioning, in the area of power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry and has a contract value of INR 300 million or more, the details of which are given below:

	S.No.	Item Description	Details	Supporting documents for details furnished under column (3)
	(1)	(2)	(3)	(4)
		i. Name of the reference contracts/works and its location		
		ii. Name of the client / owner with full address, phone, fax & e-mail		
		iii. The value of such contracts		
		iv. Details of type of industry/area of execution of contract. (whether power, steel, oil & gas, petro-chemical, fertilizer and / or any other process industry)		
		v. Date of commissioning of such projects		

date from which the project
is in successful operation condition

vi. Whether Bidder's scope of work includes

- | | | |
|-------|--|----------|
| (i) | Engineering | *Yes/*No |
| (ii) | Supply | *Yes/*No |
| (iii) | Erection/Supervision of erection | *Yes/*No |
| (iv) | Commissioning/ *Supervision of Commissioning | *Yes/*No |

Note:

1. Bidder may use similar format for furnishing, separately, qualification data for a maximum of three (3) times the reference plants, as per provisions of Clause no. 4.0 of Section-III (BDS).

2a. The word “executed” means the Bidder should have:

in case of Project(s), commissioned the project(s), even if the contract has been started earlier and / or is not completed / closed. in case of Contract(s), completed the scope of work under the contract(s), even if the contract has been started earlier and / or is not closed.

2b. The word “be executing” means the Bidder should have received the contract prior to the date of techno-commercial bid opening.

2. Copies of Order / Letter of Award/Contract Agreement/Client Certificate and Performance Certificate from the clients, etc. are to be enclosed clearly establishing the scope of work/ years of successful operation, etc. in support of meeting the Qualifying Requirements.

3. Continuation sheets of like size and format may be used if the bidder wishes to provide additional reference plants as per BDS Item No. 4.0.

Further, In line with the Note-1 to clause 6.1.0 or 6.2.0 or 6.3.0 of Invitation for Bids, Section-I of Bidding Documents Our Holding Company is meeting qualifying requirements specified in Item No. 6.1.0 or 6.2.0 or 6.3.0 of Invitation for Bids, Section-I of Bidding Documents collectively along with its subsidiaries, the details of the subsidiaries meeting qualifying requirement are given below:

Gas Engine Details:

S.No.	Item Description	Details	Supporting documents for details furnished under column (3)
(1)	(2)	(3)	(4)
1.	Name, address, e-mail, Tel. No. and Fax No. of the Subsidiary		
1.	Name and Designation of the responsible person		
2.	Name of the reference stations and its location		
3.	Name of the client/owner with full address, phone, fax & e-mail		
5.	(i) Name of Holding Company:-- (iii) Name of Subsidiaries:-		
6.	(i) Scope of Holding Company:-- (iv) Scope of Subsidiaries:-		
7.	Rating of Gas Engine		
8.	Logged fired hours since commissioning		
9.	Date of commissioning of Gas Engine (a) date from which the system is in successful operation condition (b) Duration of successful operation prior to the date of techno-		

commercial bid opening

10. Whether scope of work includes

- (i) Design *Yes/*No
- (ii) Manufacturing *Yes/*No
- (iii) Supply *Yes/*No
- (iv) *Commissioning/ *Supervised
Commissioning *Yes/*No

11. Purpose for which Gas engine Installed
i.e. Power generation/other

12. We have submitted the experience details in support of Qualifying Requirement above with reference to above subsidiary (ies). We are attaching the necessary documentary evidence as Annexure of this Attachment establishing the relationship between us and above subsidiaries.(Bidder should repeat the same format as per clause 4.0 above for other subsidiaries, if any

13. We further confirm that notwithstanding anything stated above, the Employer reserves the right to assess the capabilities and capacity of the Bidder/his collaborators/associates/subsidiaries/group companies to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer.

Date : (Designation)

Place : (Printed Name)

Note:

1. Bidder may use similar format for furnishing, separately, qualification data for a maximum of three (3) reference plants, as per provisions of Clause no. 4.0 of Section-III (BDS).
2. Copies of Order / Letter of Award/Contract Agreement/Client Certificate and Performance Certificate from the clients, etc. are to be enclosed clearly establishing the scope of work/ years of successful operation, etc. in support of meeting the Qualifying Requirements.
3. Continuation sheets of like size and format may be used if the bidder wishes to provide further additional reference plants as per BDS Item No. 4.0.

Undertaking from Independent Statutory Auditor

(On letter head digitally signed by a person duly authorized to Sign on behalf of the Statutory Auditor)

Bid Ref. No:

Date:

To,
NVVN Ltd.
.....

Subject: Authentication of veracity of documents submitted by M/s in support of meeting the Qualifying Requirements

Ref: IFB/Tender no.

Name of the Package/ Tender:

Dear Sir,

M/s. (hereinafter called Bidder) having Registered office at
..... intend to participate in above referred tender of NVVN Ltd. We, M/s
..... have been appointed as Statutory Auditor for the Bidder i.e. M/s
.....(Relevant documents on our appointment attached)

The tender condition stipulates that the bidder shall submit supporting Documents pertaining to Technical Qualifying Requirement duly verified and certified by Statutory Auditor. In this regard, it is hereby confirmed that we have examined the following documents, which are also attached with this letter. The same has been verified from the Original Documents and/ or Client for authenticity.

We hereby confirm that the following documents are found to be genuine and authentic.

1. Doc ref. no. dated (name of Documents)
2. Doc ref. no. dated (name of Documents)
3.

All the aforesaid documents have been digitally signed by us as a certificate of authenticity.

*Further, we have examined the books of accounts, records, and other relevant documents, along with other necessary information and explanations furnished by M/s. (bidder) and hereby certify following:

.....

This certificate is issued at the request of M/s (Bidder) for the purpose of participating in tender/s.

Thanking you,
.....

* *Strike off, whichever is not applicable.*

**Undertaking from Third Party Inspection Agency
(on letter head digitally signed by a person duly authorized to Sign on behalf of the TPIA)**

Bid Ref. No:

Date:

To,
NVVN Ltd.
.....

Dear Sir,

Subject: Authentication of veracity of documents submitted by M/s in support of meeting the Qualifying Requirements

M/s. (hereinafter called Bidder) having Registered office at intend to participate in above referred tender of NVVN Ltd.

The tender condition stipulates that the bidder shall submit supporting Documents pertaining to Qualifying Requirement duly verified and certified by a specified independent Third-Party Inspection Agency as per the list mentioned in the bidding documents.

In this regard, it is hereby confirmed that we have examined the following documents, which are also attached with this letter. The same has been verified from the Original Documents and / or Client for authenticity.

We hereby confirm that the following documents are found to be genuine and authentic.

1. Doc ref. no. dated (name of Documents)
2. Doc ref. no. dated (name of Documents)
3.

All the aforesaid documents have been digitally signed by us as a certificate of authenticity. We further confirm that we neither have any vested interest in aforesaid tender nor have any conflict of interest in respect of above tender.

This certificate is issued at the request of M/s (Bidder) for the purpose of participating in the subject tender/s.

Thanking you,

.....
** Strike off, whichever is not applicable.*

UNDERTAKING FOR SITE VISIT ON BIDDER'S LETTER HEAD
(Submission of undertaking for site visit on bidder's letter head is
mandatory. Without this undertaking bids shall be outright rejected)

Tender ref No: **NVVNC&M/RE-333/2024-25**

Tender Description: **ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)**

To,

NVVN Limited

Dear Sir,

With ref to above tender, As Site survey is mandatory for all the bidders who are willing
to participate in this tender.

We hereby confirm/declare that we are willing to participate & we had visited Site to
make ourselves familiar with site conditions as per tender requirement.

Thanking you

Yours faithfully,

Date :

Place :

(Signature).....
(Printed Name).....
(Designation).....
(Common Seal).....

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

(Details pertaining to Financial Qualification of the bidder as per Item
No. 6.4.1.0 of the Invitation for Bid)

- (A) We confirm that our average annual turnover of the preceding three (3) financial years as on date of Techno-Commercial bid opening is not less than **INR 1977 Million (Indian Rupees One Thousand Nine Hundred Seventy Seven Million only)** or in equivalent foreign currency. In support of above, we are enclosing audited financial statements and the details are as under:

Sl. No	Financial Year	Amount in Bidder's Currency	Amount in INR (Million)	Exchange Rate as on seven (7) days prior to date of Techno-Commercial bid opening
1.	2023-24			
2.	2022-23			
3.	2021-22			
4.	Average Annual Turnover for the preceding three (3) Financial Years as on date of Techno-Commercial Bid Opening.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	We have enclosed Audited financial statements for the last 3 financial years	YES <input type="checkbox"/> */NO* <input type="checkbox"/>	YES <input type="checkbox"/> */NO* <input type="checkbox"/>	YES <input type="checkbox"/> */NO* <input type="checkbox"/>

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

(Details pertaining to Financial Qualification of the bidder as per Item No. 6.4.1.2/6.4.1.3 of the Invitation for Bid)

- B) We hereby confirm that net worth of our company as on the last day of the preceding financial year is not less than 100% of its paid-up share capital.

The Details are as under:

Sl. No	Description	As on last day of the preceding financial year
1.	Paid-up Share Capital	
2.	Net Worth	
3.	%age of Net worth to Paid-up Share Capital	
4.	Documentary evidence like Annual reports/ Audited financial statements for the last 3 financial years in support of above is enclosed at Annexure. to this Attachment-3A-2	
5.	<p>Since we are not able to furnish our audited financial statements, on standalone entity basis, we are submitting the following documents for substantiation of our Qualification :</p> <p>(a) Copies of unaudited unconsolidated financial statements of the bidder alongwith copies of the audited consolidated financial statements of the Holding Company for the last 3 years enclosed at Annexure to this Attachment 3A-2.</p> <p>(b) Certificate from the CEO/CFO of the Holding company stating that the unaudited unconsolidated financial statements form part of the consolidated financial statements of the Holding Company, is enclosed as per the format at Appendix-A to this Attachment-3A-2.</p>	

For Bidders meeting requirement of Item No. 6.4.1.1 and/or 6.4.1.2 of IFB based on the strength of their *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies

- (a) Since we do not satisfy the financial criteria stipulated at Clause 6.4.1.1 of IFB on our own, we meet the requirement of average annual turnover based on the strength of our Holding Company who meet the stipulated turnover requirements of IFB Item No. 6.4.1.1 and whose networth as on the last day of the preceding financial year is atleast equal to or more than paid up share capital of the holding company.

Sl. No.	Description	As on last day of the preceding financial year
1.	Name and Address of the Holding Company	
2.	The annual turnover of the holding company in the preceding three financial years in Indian Rupees (INR) or in Foreign Currency (FC)\ 2023-2024 2022-2023 2021-2022	
3.	The average annual turnover of the holding company of the preceding three financial years as on the date of techno-commercial bid opening	
4.	We have enclosed Annual Reports/ Audited Financial Statements for the last 3 financial years of the Holding Company	YES <input type="checkbox"/> */NO* <input type="checkbox"/>
5.	Paid-up Share Capital of the Holding Company	
6.	Net Worth of the Holding Company	
7.	%age of Net worth to Paid-up Share Capital	
8.	A Letter of Undertaking from the holding company supported by Board Resolution of the Holding Company, pledging unconditional and irrevocable financial support for execution of the contract by the bidder in case of award, is enclosed as per the format at Appendix-B to this Attachment-3A-2. A power of attorney of the person signing on behalf of holding company is also enclosed at Annexure to this Attachment-3A-2.	
9.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Holding Company in support of above is enclosed at Annexure to this Attachment-3A-2.	

(b) Since we do not satisfy the financial criteria stipulated at Clause 6.4.1.2 of IFB on our own, we meet the requirement of net worth based on the strength of our *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies, and the Net worth of the Bidder and its *Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company, in combined manner is not less than 100% of their total paid up share capital and individually, their Net worth is not less than 75% of their respective paid up share capitals.

Sl. No.	Description	As on last day of the preceding financial year
1.	Name and Address of the Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company	
2.	Paid-up Share Capital of the Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company	
3.	Net Worth of the Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company	
4.	%age of Net worth to Paid-up Share Capital	
5.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company in support of above is enclosed at Annexure _____ to this Attachment-3A-2.	

* Bidder to strike-off whichever is not applicable.

We further confirm that notwithstanding anything stated above, the Employer reserves the right to verify any information/documents furnished by the Bidder and also to carry out assessment of the capabilities and capacity of the bidder/his collaborators / associates / subsidiaries / group companies to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer .

Date : (Printed Name).....

Place : (Designation).....

Notes :

(i) In case where audited results for the last financial year as on the date of Techno commercial bid opening are not available, the financial results certified by a practicing Chartered Accountant shall be considered acceptable. In case, party is not able to submit the Certificate from a practicing Chartered Accountant certifying its financial parameters, the audited results of three consecutive financial years preceding the last financial year shall be considered for evaluating the financial parameters provided party submits a Certificate from the CEO/CFO as per the format enclosed at Appendix-D to this Attachment-3A-2.

- (ii) Net worth means the sum total of the paid up share capital and free reserves. Free reserve means all reserves credited out of the profits and share premium account but does not include reserves credited out of the revaluation of the assets, write back of depreciation provision and amalgamation. Further, any debit balance of Profit and Loss account and miscellaneous expenses to the extent not adjusted or written off, if any, shall be reduced from reserves and surplus.
- (iii) Other income shall not be considered for arriving at annual turnover.
- (iv) "Holding Company" and "Subsidiary Company" shall have the meaning ascribed to them as per Companies Act of India.
- (v) For annual turnover indicated in foreign currency, the exchange rate as on seven (7) days prior to the date of Techno-Commercial bid opening shall be used.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

(Details pertaining to Financial Qualification of the bidder as per Item No. 6.4.2.1 of the Invitation for Bid)

- (A) We confirm that our(Associate/Collaborator) average annual turnover of the preceding three (3) financial years as on date of bid opening is not less than **INR 989 Million (Indian Rupees Nine Hundred Eighty Nine Million only)** or in equivalent foreign currency. In support of above, we are enclosing audited financial statements.

Sl. No	Financial Year	Amount Bidder's Currency in	Amount in INR (Million)	Exchange Rate as on seven (7) days prior to date of Techno-Commercial bid opening
1.	2023-24			
2.	2022-23			
3.	2021-22			
4.	Average Annual Turnover of the preceding three (3) Financial Years as on date of Techno-Commercial Bid Opening.	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
5.	We have enclosed Audited financial statements for the last 3 financial years	YES */NO*	YES */NO*	YES */NO*

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

*(Details pertaining to Financial Qualification of the bidder as per
Item No. 6.4.2.2 of the Invitation for Bid)*

- B) We hereby confirm that net worth of our..... **(Associate/Collaborator)** as on the last day of the preceding financial year is not less than 100% of its paid-up share capital. The

Details are as under:

Sl. No	Description	As on last day of the preceding financial year
1.	Paid-up Share Capital	
2.	Net Worth	
3.	%age of Net worth to Paid-up Share Capital	
4.	Documentary evidence like Annual reports/ Audited financial statements for the last 3 financial years in support of above is enclosed at Annexure. to this Attachment-3A-4	
5.	<p>Since we are not able to furnish our audited financial statements, on standalone entity basis, we are submitting the following documents for substantiation of our Qualification :</p> <p>(a) Copies of the unaudited unconsolidated financial statements of the Collaborator/Associate alongwith copies of the audited consolidated financial statements of its Holding Company for the last 3 years enclosed at Annexure to this Attachment 3A-4.</p> <p>(b) Certificate from the CEO/CFO of the Holding company stating that the unaudited unconsolidated financial statements form part of the consolidated financial statements of the Holding Company, is enclosed as per the format at Appendix-A to Attachment-3A-2.</p>	

For Associate/Collaborator meeting requirement of Item No. 6.4.2.1 and/or 6.4.2.2) of IFB based on the strength of their *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies

- (a) Since our**(Associate/Collaborator)** do not satisfy the financial criteria stipulated at Clause 6.4.2.1 of BDS on its own, they meet the requirement of average annual turnover based on the strength of their Holding Company who meet the stipulated turnover requirements of BDS Item No. 6.4.2.1 and whose net worth as on the last day of the preceding financial year is at least equal to or more than paid up share capital of the holding company.

Sl. No.	Description	As on last day of the preceding financial year
1.	Name and Address of the Holding Company	
2.	The annual turnover of the holding company in the preceding three financial years in Indian Rupees (INR) or in Foreign Currency (FC) 2023-2024 2022-2023 2021-2022	
3.	The average annual turnover of the holding company of the preceding three financial years as on the date of techno-commercial bid opening	
4.	We have enclosed Annual Reports/ Audited Financial Statements for the last 3 financial years of the Holding Company	YES <input type="checkbox"/> */NO* <input type="checkbox"/>
5.	Paid-up Share Capital of the Holding Company	
6.	Net Worth of the Holding Company	
7.	%age of Net worth to Paid-up Share Capital	
8.	A Letter of Undertaking from the holding company supported by Board Resolution, pledging unconditional and irrevocable financial support for execution of the contract by the bidder in case of award, is enclosed as per the format at Appendix-B to Attachment-3A-2. A power of attorney of the person signing on behalf of holding company is also enclosed at Annexure to this Attachment-3A-2.	
9.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Holding Company in support of above is enclosed at Annexure to this Attachment-3A-2.	

- (b) Since our**(Associate/Collaborator)** do not satisfy the financial criteria stipulated at Clause 6.4.2.2 of BDS on their own, they meet the requirement of net worth based on the strength of their *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies, and the Net worth of our..... **(Associate/Collaborator)** and its *Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company, in combined manner is not less than 100% of their total paid up share capital and individually, their Net worth is not less than 75% of their respective paid up share capitals.

Sl. No.	Description	As on last day of the preceding financial year
1.	Name and Address of the Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company	
2.	Paid-up Share Capital of the Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company	
3.	Net Worth of the Subsidiary(ies) and/or* Holding Company and/or *Subsidiary(ies) of the Holding Company	
4.	%age of Net worth to Paid-up Share Capital	
5.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies in support of above is enclosed at Annexure to this Attachment-3A-4.	

* Bidder to strike-off whichever is not applicable.

We further confirm that notwithstanding anything stated above, the Employer reserves the right to verify any information/documents furnished by the Bidder and also to carry out assessment of the capabilities and capacity of the bidder/his collaborators / associates / subsidiaries / group companies to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer.

Date : (Printed Name).....

Place : (Designation).....

Notes :

- (i) In case where audited results for the last financial year as on the date of Techno commercial bid opening are not available, the financial results certified by a practicing Chartered Accountant shall be considered acceptable. In case, party is not able to submit the Certificate from a practicing Chartered Accountant certifying its financial parameters, the audited results of three consecutive financial years preceding the last financial year shall be considered for evaluating the financial parameters provided party submits a Certificate from the CEO/CFO as per the format enclosed at Appendix-D to this Attachment-3A-2.
- (ii) Net worth means the sum total of the paid up share capital and free reserves. Free reserve means all reserves credited out of the profits and share premium account but does not include reserves credited out of the revaluation of the assets, write back of depreciation provision and amalgamation. Further, any debit balance of Profit and Loss account and miscellaneous expenses to the extent not adjusted or written off, if any, shall be reduced from reserves and surplus.
- (iii) "Holding Company" and "Subsidiary Company" shall have the meaning ascribed to them as per Companies Act of India.
- (iv) For annual turnover indicated in foreign currency, the exchange rate as on seven (7) days prior to the date of Techno-Commercial bid opening shall be used.
- (v) For Turnover and Net worth, only standalone Financial Statement of Bidder/ Associate/ Collaborator/ Holding/ subsidiary(s) shall be considered.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

(Details pertaining to Financial Qualification of the bidder as per Item No. 6.4.3.0 of the Invitation for Bid)

- (A) We confirm that our Holding Company average annual turnover of the preceding three (3) financial years as on date of Techno-Commercial bid opening is not less than **INR 1977 Million (Indian Rupees One Thousand Nine Hundred Seventy Seven Million only)**, or in equivalent foreign currency. In support of above, we are enclosing audited financial statements and the details are as under:

Sl. No	Financial Year	Amount in Bidder's Currency	Amount in INR (Million)	Exchange Rate as on seven (7) days prior to date of Techno-Commercial bid opening
1.	2023-2024			
2.	2022-2023			
3.	2021-2022			
4.	Average Annual Turnover of the preceding three (3) Financial Years as on date of Techno- Commercial Bid Opening.			
5.	We have enclosed Audited financial statements for the last 3 financial years	YES */NO* <input type="checkbox"/> <input type="checkbox"/>	YES */NO* <input type="checkbox"/> <input type="checkbox"/>	YES */NO* <input type="checkbox"/> <input type="checkbox"/>

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

*(Details pertaining to Financial Qualification of the bidder as per
Item No. 6.4.3.0 of the Invitation for Bid)*

- a) We hereby confirm that net worth of our Holding company as on the last day of the preceding financial year is not less than 100% of its paid-up share capital.

The Details are as under:

SI. No	Description	As on last day of the preceding financial year
1.	Paid-up Share Capital	
2.	Net Worth	
3.	%age of Net worth to Paid-up Share Capital	
4.	Documentary evidence like Annual reports/ Audited financial statements for the last 3 financial years in support of above is enclosed at Annexure. to this Attachment-3A-2	

- (b) Since our Holding Company do not satisfy the financial criteria stipulated at Clause 6.4.1.2 of IFB on our own, we meet the requirement of net worth based on the strength of our *Subsidiary(ies), and the Net worth of the our Company and *Subsidiary(ies), in combined manner is not less than 100% of their total paid up share capital and individually, their Net worth is not less than 75% of their respective paid up share capitals.

Sl. No.	Description	As on last day of the preceding financial year
6.	Name and Address of the *Subsidiary(ies) of the Holding Company	
7.	Paid-up Share Capital of the Subsidiary(ies) of the Holding Company	
8.	Net Worth of the Subsidiary(ies) of the Holding Company	
9.	%age of Net worth to Paid-up Share Capital	
10.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Holding Company/*subsidiaries/*subsidiaries of the Holding Company in support of above is enclosed at Annexure to this Attachment-3A-2.	

* Bidder to strike-off whichever is not applicable.

- (c) Since bidder, an Indian subsidiary are participating as a partner (jointly formed among the bidder, its holding company and/or its directly or indirectly held subsidiaries as per IFB clause 6.1.1.0) we confirm , the net worth of all members in combine manner are not less than 100% of their paid up share capital and individually, their Net worth is not less than 75% of their respective paid up share capitals.

Bidder

Sl. No.	Description	As on last day of the preceding financial year
1.	Paid-up Share Capital of the Bidder	
2.	Net Worth of the Bidder	
3.	%age of Net worth to Paid-up Share Capital	
4.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Holding Company in support of above is enclosed at Annexure to this Attachment-3A-2.	

Holding Company

Sl. No.	Description	As on last day of the preceding financial year
1.	Name and Address of the Holding Company	
2.	Paid-up Share Capital of the Holding Company	
3.	Net Worth of the Holding Company	
4.	%age of Net worth to Paid-up Share Capital	
5.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Holding Company in support of above is enclosed at Annexure to this Attachment-3A-2.	

Subsidiary of Holding Company

Sl. No.	Description	As on last day of the preceding financial year
1.	Name and Address of the *Subsidiary(ies) of the Holding Company	
2.	Paid-up Share Capital of the Subsidiary(ies) of the Holding Company	
3.	Net Worth of the Subsidiary(ies) of the Holding Company	
4.	%age of Net worth to Paid-up Share Capital	
5.	Documentary evidence like Annual Report/Audited Financial Statements together with relevant schedules for the last preceding financial year/certification of financial statements from a practicing Chartered Accountant etc. in respect of Holding Company in support of above is enclosed at Annexure to this Attachment-3A-2.	

We further confirm that notwithstanding anything stated above, the Employer reserves the right to verify any information/documents furnished by the Bidder and also to carry out assessment of the capabilities and capacity of the bidder/his collaborators / associates / subsidiaries / group companies to perform the contract, should the circumstances warrant such assessment in the overall interest of the Employer.

Date : (Printed Name).....

Place : (Designation).....

Notes :

- (i) In case where audited results for the last financial year as on the date of Techno commercial bid opening are not available, the financial results certified by a practicing Chartered Accountant shall be considered acceptable. In case, party is not able to submit the Certificate from a practicing Chartered Accountant certifying its financial parameters, the audited results of three consecutive financial years preceding the last financial year shall be considered for evaluating the financial parameters provided party submits a Certificate from the CEO/CFO as per the format enclosed at Appendix-D to this Attachment-3A-2.
- (ii) Net worth means the sum total of the paid up share capital and free reserves. Free reserve means all reserves credited out of the profits and share premium account but does not include reserves credited out of the revaluation of the assets, write back of depreciation provision and amalgamation. Further, any debit balance of Profit and Loss account and miscellaneous expenses to the extent not adjusted or written off, if any, shall be reduced from reserves and surplus.
- (iii) Other income shall not be considered for arriving at annual turnover.
- (iv) "Holding Company" and "Subsidiary Company" shall have the meaning ascribed to them as per Companies Act of India.
- (v) For annual turnover indicated in foreign currency, the exchange rate as on seven (7) days prior to the date of Techno-Commercial bid opening shall be used.
- (vi) For Turnover and Net worth, only standalone Financial Statement of Bidder/Associate/Collaborator/Holding/subsidiary(s) shall be considered.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

**PROFORMA OF CERTIFICATE FROM THE CEO/CFO OF THE HOLDING COMPANY IN
ACCORDANCE WITH ITEM NO *6.4.1.3 (ii)/ * 6.4.2.3 (ii) OF IFB
(To be submitted by *Bidder /*Associate/Collaborator along with the Bid)**

- 1.0 I, Mr (CEO/CFO of the holding company) *, declare that M/s (Name of the Holding Company) is the Holding Company of M/s (Name of the *Bidder/ *Associate/ Collaborator).
- 2.0 I hereby confirm and undertake that the unaudited unconsolidated financial statements submitted in respect of the *Bidder/ *Associate/Collaborator as part of the bid reference no ----- dated----- have been considered for the purposes of the finalization of consolidated financial statements of the Holding Company as part of the Annual Reports.
- 3.0 I further, certify that the figures in the unaudited unconsolidated financial statements are true and correct and same have been duly reflected in the audited consolidated financial statements and/or Annual Report of the Holding Company.

*** Strike off whichever is not applicable.**

Yours faithfully,
(Signature)

Date: Name & Designation.....
Place: Name of the Holding Company.....
Seal of the Holding Company.....

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

PROFORMA OF LETTER OF UNDERTAKING

(TO BE FURNISHED ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

[To be executed by the Holding Company Supported by Board Resolution and submitted by the Bidder along with the Bid, in case financial support is being extended by the Holding Company to the *Bidder /* Associate/Collaborator for meeting the stipulated Financial Qualifying Requirement as per Item No. *6.4.1.1 / *6.4.2.1 of Invitation for Bid]

Dear Sir,

1.0 We, M/s _____ declare that we are the holding company of M/s (Name of the *Bidder/*Associate/Collaborator) and have controlling interest therein.

M/s (Name of the Bidder) proposes to submit the bid for the package (Name of the package) for (Name of the Project) under bid reference no dated and M/s (Name of the *Bidder/*Bidder's Associate/ Collaborator) have sought financial strength and support from us for meeting the stipulated Financial Qualifying Requirement as per Item No. *6.4.1.1 / *6.4.2.1 Invitation for Bid.

2.0 We hereby undertake that we hereby pledge our unconditional & irrevocable financial support for the execution of the said package to M/s _____ (Name of the *Bidder/*Associate/Collaborator), for the execution of the Contract, in case M/s (Name of the Bidder) are awarded the Contract for the said package at the end of the bidding process.

We further agree that this undertaking shall be without prejudice to the various liabilities that M/s _____ (Name of *Bidder/*Associate/Collaborator) would be required to undertake in terms of the Contract including the Performance Security as well as other obligations of the Bidder/Contractor.

3.0 This undertaking is irrevocable and unconditional, and shall remain in force till the successful execution and performance of the entire contract and/or till it is discharged by Employer.

4.0 We are herewith enclosing a copy of the Board Resolution in support of this undertaking.

Yours faithfully,

(Signature of Authorized Signatory on behalf of the Holding Company)

Date: _____ Name & Designation.....
Place: _____ Name of the Holding Company.....
Seal of the Holding Company.....

*** Strike Off whichever is not applicable WITNESS:**

1. 2.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVNC&M/RE-333/2024-25

PROFORMA OF LETTER OF UNDERTAKING

(TO BE FURNISHED ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

[To be executed by *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies Supported by Board Resolution and submitted by the Bidder alongwith the Bid, Applicable to the *Bidder /*Associate/Collaborator for meeting the stipulated Financial Qualifying Requirement as per Item No. *6.4.1.2/ *6.4.2.2/6.4.2.4 of Invitation for Bid]

Dear Sir,

1.0 We, M/s declare that we are the *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding companies of M/s (*Bidder /*Associate/Collaborator) and have controlling interest therein.

M/s. (Name of the Bidder) proposes to submit the bid for the package (Name of the package) for (Name of the Project) under bid reference no. dated and M/s (*Bidder/*Bidder's Associate/Collaborator) have sought financial strength and support from us for meeting the stipulated Financial Qualifying Requirement as per Item No. *6.4.1.2 /*6.4.2.2/6.4.3.0 of IFB.

2.0 We hereby undertake that we hereby pledge our unconditional & irrevocable financial support for the execution of the said package to M/s. (Name of the *Bidder/*Associate/Collaborator), in case M/s (Name of the Bidder) are awarded the Contract for the said package, at the end of the bidding process.

We further agree that this undertaking shall be without prejudice to the various liabilities that M/s (Name of *Bidder/*Associate/Collaborator) would be required to undertake in terms of the Contract including the Performance Security as well as other obligations of the Bidder/Contractor.

3.0 This undertaking is irrevocable and unconditional, and shall remain in force till the successful execution and performance of the entire Contract and/or till it is discharged by Employer.

4.0 We are herewith enclosing a copy of the Board Resolution in support of this undertaking.

Yours faithfully,

Date:

(Signature of Authorised Signatory on behalf of the *Subsidiary(ies) and/or *Holding Company and/or *Subsidiaries of the Holding Companies)

*** Strike Off whichever is not applicable**

Witness:

(1)

(2)

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

**PROFORMA OF CERTIFICATE FROM THE CEO/CFO OF THE BIDDER / ASSOCIATE /
COLLABORATOR IN ACCORDANCE WITH ITEM NO. *6.4.1.3 / *6.4.2.3 OF IFB
(To be submitted by *Bidder /*Associate/Collaborator along with the Bid)**

Ref. :

Date:

To

NVVN Limited
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sirs,

1.0 I, Mr./Ms. (CEO / CFO* of M/s (Name of the
*Bidder / *Associate / Collaborator / *Subsidiary(ies) / *Holding Company / *Subsidiaries of the
Holding companies) hereby confirm and undertake that the Financial results of the Company are
under audit as on the date of Techno-commercial bid opening for the
package (Name of the package).

2.0 I further, declare that the Certificate from the practicing Chartered Accountant certifying the financial
parameters of M/s (Name of the *Bidder / *Associate / Collaborator /
*Subsidiary(ies) / *Holding Company / *Subsidiaries of the Holding companies) for the last
financial year is not available.

*** *Strike off whichever is not applicable.***

Yours faithfully

(Signature)

Date : (Name & Designation)

Place: (Name of the Company)

(Seal of Company)

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25

(Financial Capacity Status of Bidder and/or wherever applicable, his Associate(s)/Collaborator(s))

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

-
- A) Orders in Hand
- i) Total value of Contracts
- ii) Value of work completed out of above value up to March' 2024
- iii) Value of anticipated work to be performed in the following Financial Years:

2024 - 2025

2025 - 2026

2026- 2027

2027- 2028

2028- 2029

B) Bidder's assessment of maximum negative cash flow (fund requirement) at any point of time between Notification of Award and completion of contract based on specified terms of payment and his expenditure plan for Plant & equipment being offered by bidder for this package.

C) Arrangement to meet the above fund requirement.

<u>Own Funds</u>	<u>Credit</u>	<u>Others</u>	<u>Total</u>
------------------	---------------	---------------	--------------

D) Gross Turnover of Company during:

Year ending - March 2020

Year ending - March 2021

Year ending - March 2022

Year ending - March 2023

Year ending - March 2024

E) Balance Sheet and Profit & Loss Account duly certified by a Chartered Accountant for the last 5 years is to be submitted.

Enclosed at Annexure
to this Attachment-3B

F) Declaration by Bankers or the Chartered Accountant regarding :

i) Bank Guarantee Limits

Enclosed at:.....

ii) Over Draft Limits/Cash Credit Limits

Enclosed at:

- iii) Deferred payment limits. Enclosed at:
- iv) Fixed Deposits Enclosed at:
- v) Movable Property Hypothecation.
(Please state the present utilization status also) Enclosed at:
- G) Information regarding any current litigation in which the Bidder is involved, the parties concerned, the disputes and the disputed amount if any. Enclosed at:

Date : (Designation).....
Place : (Printed Name).....

- Note :**
- 1. The above Attachment shall be filled-up by the bidder for **himself** and for each **Associate/Collaborator** being proposed by the bidder in his bid.
 - 2. Continuation sheets of like size and format, may be used and annexed to this Attachment if required.
 - 3. Financial details to be furnished by the bidder in this Attachment-3B shall be same as the details already furnished in Attachment-3A.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
(Details of Design, Engineering, Manufacturing and Testing Capabilities of Bidder and/or wherever applicable, his Associate/Collaborator/ JV partner)

Bidder's Name and Address: To
NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

(1) We hereby confirm that we do not anticipate any change in ownership during proposed period of execution of the work (if such a change is anticipated, the scope and effect there of shall be defined). The relevant document for same (i.e. in case of change of Ownership) is enclosed to Annexure. to this Attachment-3C.

(2) We have also furnished adequate detailed write up on the following :

- (i) Design and Engineering Organisation and facilities/ capabilities : Enclosed at Annexure to this Attachment-3C
(ii) Manufacturing & Testing Organization and facilities available : Enclosed at Annexure to this Attachment-3C
(iii) Field Organisation and resources for erection, testing & commissioning etc. : Enclosed at Annexure to this Attachment-3C
(iv) Quality Assurance Organisation and capabilities for Engg., manufacturing & field installation. : Enclosed at Annexure to this Attachment-3C
(v) Established Project Management : Enclosed at Annexure to this Attachment-3C

(3) Additional details (if any) in respect of Manufacturing and Testing Facilities

----- Date :
(Designation).....

Place : (Printed Name).....

- Note : 1. The above attachment shall be filled up by the bidder for himself and for Subcontractor(s) / Associate(s)/ Collaborator(s) if any, being proposed by the Bidder in his bid and relevant details shall be furnished.
2. Continuation sheets of same size and format shall be added by the Bidder and annexed to this Attachment, if required.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
(Details of Manufacturing Capacities/Plant Loading of the Bidder and Associate(s)/Collaborator(s) wherever applicable)

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

We hereby furnish below the details of our installed capacities and work in hand to establish spare capacity for completion of work under this package.

Item	2024 – 2025			2025 - 2026			2026 - 2027			2027 – 2028			2028 - 2029		
	Bidder's Shop	Collaborator/ Associate's shop	Sub Contractor's shop	Bidder's Shop	Collaborator/ Associate's shop	Sub Contractor's shop	Bidder's Shop	Collaborator/ Associate's shop	Sub Contractor's shop	Bidder's Shop	Collaborator/ Associate's shop	Sub Contractor's shop	Bidder's Shop	Collaborator/ Associate's shop	Sub Contractor's shop
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.
A) Production Capacity as installed															
B) Firm orders in hand upto date of Techno Commercial Bid Opening															
C) Balance Capacity Available															
D) Orders Expected															

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16
E) Work Load Expected for this contract															
F) Shortfall, if any															
G) Alternative arrangements to make up for this short fall															

Date : (Designation).....
Place : (Printed Name).....

Note : Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
(Present Order Book Position)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

List of Orders of Last 5 Years and Present Status

Sl. No.	Client	Order Value	No. of Units & Unit size	Date of Order	Present Status		% work completed	Completion of supply		Completion of Erection testing & commissioning		Reason for delay (if any)
					Sch-edule	Actual/Expected		Sch-edule	Actual/Expected	Sch-edule	Actual/Expected	

Date :

(Designation).....

Place :

(Printed Name).....

- Note :**
- The above attachment shall be filled up by the bidder for **himself** and for each of the major Subcontractor(s)/associate/collaborator, if any, being proposed by the bidder in his bid.
 - Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
(Past Performance Data)

Bidder's Name and Address :

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

Details of Similar Equipment Commissioned/Supplied in last ten years :

Sl. No.	Client Name & Address	Date of order	Unit size & No. of Units	Date of Completion of Supplies		Date of Completion of Erection, Testing & Commissioning		Order Value	Reason for Delay (if applicable)
				Schedule	Actual	Schedule	Actual		

Date :

(Designation).....

Place :

(Printed Name).....

- Note :**
1. The above attachment shall be filled up by the bidder for **himself** and for Subcontractor(s)/associate/collaborator, if any, being proposed by the bidder in his bid.
 2. Continuation sheets of like size & format may be used if required and annexed to this Attachment.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
(Data regarding key construction personnel)

Bidder's Name and Address :

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

The qualification and experience of key constructional personnel proposed for administration and execution of the contract at site are as follows:

Sl.No.	Name	Qualification	Position/Designation	Experience
--------	------	---------------	----------------------	------------

Date : (Designation).....

Place : (Printed Name).....

- NOTE:
1. The above attachment shall be filled up by the bidder for **himself** and for the Subcontractor(s)/associate/collaborator, if any, being proposed by the bidder in his bid.
 2. Continuation sheets of like size & format may be used if required and annexed to this Attachment.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25**

(Manpower loading data)

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301

We declare that our manpower loading during execution of the contract will be as follows:

No. of months from the date of Notification of Award	1	2	3	4	5	6	7	8	9	10.....	28
--	---	---	---	---	---	---	---	---	---	---------	----

Labour (Category)

..... Date :

(Designation).....

Place :

(Printed Name).....

- Note :**
1. The above Attachment shall be filled by the bidder for **himself** and for each associate/collaborator being proposed by the bidder in his bid.
 2. Continuation sheets of like size & format may be used if required and annexed to this Attachment.
 3. List of category of labour will be given by the Bidder.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
[TO BE SUBMITTED IN PHYSICAL FORM IN A SEPARATE SEALED ENVELOPE]**

Bidder's Name and Address: _____ To NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301, India

Sub: Letter to ensure successful performance of *Gas Engines/ *Contract for Andaman & Nicobar Gas Power Project Package.

Dear Sirs,

This has reference to your IFB reference no. _____ for the captioned package. We -----
----- (Name of *Engine Manufacturer /*Holding Company (along with our subsidiaries
(if applicable)) confirm that in case of the award of the 'Contract' for the subject package to ---
----- (name of the Bidder), we shall be only responsible for the ***successful
performance of Gas Engines covered under the contract/ *execution and successful
performance of Contract.**

We, hereby undertake and confirm that this Letter shall be irrevocable and valid up to the end
of the defect liability period of the contract.

Signature(s) of *Engine Manufacturer's /*Holding Company's (*along with our subsidiaries (if
applicable)) CEO/MD _____

Name(s) _____

Designation _____

Date _____

Seal of the Company

*** Strike off whichever is not applicable.**
(On company Letter Head of *Engine Manufacturer)
As per Section-I IFB - clause 6.1.2.0 & 6.1.3.0

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25
PROJECT MANAGEMENT ORGANISATION**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301, India

Dear Sirs,

1.0 In line with clause No. ITB 8.1.4(a)(v) and requirements of Para 2(v) of Attachment-3C, we furnish below the brief write up in support of our established project management organization.

----- Date :

(Designation).....

Place : (Printed Name).....

* Bidder to use their own format for above details.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301, India

Summary of Critical Equipment indicated under clause 15.00.00, volume-IV, Part-A of Section-VI.

Equipment Name	Sub-Vendor Name	Collaborator's Name, if applicable	Seeking Qualification as per clause..... Sub-Section-I, Part-A of Section-VI
Starting Air system			*15.02.01
Engine Lube Oil system			*15.02.01
Engine Cooling system			*15.02.01
Exhaust Gas system			*15.02.01
Fire Detection and Protection system			*15.03.00
Compressed Air system			*15.04.00
Solar PV Rooftop			*15.06.00/*15.06.01/*15.06.02

***Strike-off whichever is not applicable. Note :**

1. If qualification sought as per clause 15.00.00, volume-IV, Part-A of Section-VI then the details of the sub vendor (manufacturer) shall be filled by the bidder in the format A to J.

PROVENNESS DATA FOR MECHANICAL EQUIPMENTS

- A. Gas Engine:** We declare that, we have supplied gas engine which is of proven design. The offered Gas engine have logged a minimum of 4000 fired hours since commissioning and have been in successful operation for a period of at least one(01) year prior to the date of techno-commercial bid opening, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Whether equipment operating in power plant	-*Yes/*No
5.	Name of equipment manufacturer & address:	
6.	Date of commission of the Engine	
7.	Model no. of the equipment:	
8.	Brief Technical particulars of the engine:	

Sl. No.	Description	Reference Work
a.	Engine Speed -	..... rpm
b.	Power Output (Electrical generated power) – i) On RLNG	..... kWe kWe
c.	Frequency -	..... Hz
d.	No. of Cylinders	..... Nos.
e.	Bore size	..... mm
f.	Swept Volume per cylinder	..... dm ³
g.	No. of Stroke	..... nos.
h.	Stroke Length	..... mm
9.	Scope of Work: *Letter of Award or *Contract or *P.O.	enclosed at Annexure..... to Attachment-3K
10.	Performance details:	*Certificate/*Letter/*E-mail/*Performance Curve from End user enclosed at Annexure... to Attachment-3K

* Strike off whichever is not applicable.

- B. Fuel Gas Conditioning system (Not Applicable):** We declare that, we/our Sub-Vendor *manufactured/*got manufactured and supplied Engine Lube Oil system and which has been in successful operation for a period of at least one (1) year prior to the date of techno-commercial bid opening, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Name of equipment manufacturer & address:	
5.	Date of commission of the equipments:	
6.	Model no. of the equipment:	
7.	Brief Technical particulars of the equipments:	

Sl. No.	Description	Reference Work
8.	Whether the equipment(s) are in successful operation in atleast one (01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	- *Yes/*No
9.	Flue gas conditioning system details:	*Technical extract/ *paper letter/ *email/ *Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure. to Attachment-3K
10.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure. to Attachment-3K
11.	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.... to Attachment-3K

* **Strike off whichever is not applicable.**

C. HSD Forwarding system (Not Applicable): We declare that, we/our Sub-Vendor, have *manufactured/*got manufactured and supplied Engine Lube Oil system and which has been in successful operation for a period of at least one (1) year prior to the date of techno-commercial bid opening, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Name of equipment manufacturer & address:	
5.	Date of commission of the equipments:	
6.	Model no. of the equipment:	
7.	Brief Technical particulars of the equipments:	
8.	Head-	mmWC
9.	Whether the equipment(s) are in successful operation in atleast one (01) plant for a period not less than one (01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
10.	HSD forwarding system details:	*Technical extract/ *paper letter/ *email/ *Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure..... to Attachment-3K

- | | | |
|-----|----------------------|---|
| 11. | Scope of Work: | *Letter of Award or *Contract or *P.O.
enclosed at Annexure..... to Attachment-3K |
| 12. | Performance details: | *Certificate/*Letter/*E-mail from End user
enclosed at Annexure.... to Attachment-3K |
-

*** Strike off whichever is not applicable.**

D. Starting Air system: We declare that, we/our Sub-Vendor, have previously designed, (either by itself or under collaboration/Licensing agreement), *manufactured/*got manufactured and supplied the Starting Air System as required for the offered RLNG fired Engine and which has been in successful operation for a period of at least one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project package., as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	Name of equipment manufacturer & address:	
4.	Date of commission of the equipments:	
5.	Model no. of the equipment:	
6.	Brief Technical particulars of the equipments:	
7.	Capacity-	.....

Sl. No.	Description	Reference Work
8.	Whether the equipment(s) are in successful operation in at least one (01) plant for a period not less than one (01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
9.	Starting & Air system details:	*Technical extract/ *paper letter/ *email/ *Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure..... to Attachment-3K
10.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure. to Attachment-3K
11.	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.... to Attachment-3K

* **Strike off whichever is not applicable.**

E. Engine Lube Oil system: We declare that, we/our Sub-Vendor, have previously designed,*manufactured/*got manufactured and supplied Engine Lube Oil system as required for the offered RLNG fired Engine and which has been in successful operation for a period of at least one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project package, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Whether operating in a similar process/duty application	-*Yes/*No....(indicate industry type)
5.	Name of equipment manufacturer & address:	
6.	Date of commission of the equipments:	
7.	Model no. of the equipment:	
8.	Brief Technical particulars of the equipments:	
a.	Head-	..... meters of liquid column
b.	Flow	.....
9.	Whether the equipment(s) are in successful operation for in least one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No

- | | | |
|-----|---------------------------------|--|
| 10. | Engine Lube Oil system details: | *Technical extract/ *paper letter/ *email/
*Drawaing from user or *contract docu ment
or *scheme or *any document in public
domain enclosed at annexure. to
Attachment-3K |
| 11. | Scope of Work: | *Letter of Award or *Contract or *P.O.
enclosed at Annexure. to Attachment-3K |
| 12. | Performance details: | *Certificate/*Letter/*E-mail from End user
enclosed at Annexure. ... to Attachment-3K |

* **Strike off whichever is not applicable.**

F. Engine Cooling system: We declare that, we/our Sub-Vendor, have previously designed, *manufactured/*got manufactured and supplied Engine Lube Oil system as required for the offered RLNG fired Engine and which has been in successful operation for a period of at least one (1) year before Six (6) months after award date of Andaman & Nicobar Gas Power project package, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Name of equipment manufacturer & address:	
5.	Date of commission of the equipments:	

6. Model no. of the equipment:
7. Brief Technical particulars of the equipments:
8. Whether the equipment(s) are in successful operation in atleast one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder -*Yes/*No
9. Engine cooling system details: *Technical extract/ *paper letter/ *email/
*Drwaing from user or *contract docu ment
or *scheme or *any document in public
domain enclosed at annexure. to
Attachment-3K
10. Scope of Work: *Letter of Award or *Contract or *P.O.
enclosed at Annexure. to Attachment-3K
11. Performance details: *Certificate/*Letter/*E-mail from End user
enclosed at Annexure. ... to Attachment-3K
-

* **Strike off whichever is not applicable.**

G. Exhaust Gas system: We declare that, we/our Sub-Vendor, have previously designed, *manufactured/*got manufactured and supplied Engine Lube Oil system as required for the offered RLNG fired Engine and which has been in successful operation for a period of at least one (1) year before Six (6) months after award date of Andaman & Nicobar Gas Power project package, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Name of equipment manufacturer & address:	
5.	Date of commission of the equipment:	
6.	Model no. of the equipment:	
7.	Whether the equipment(s) are in successful operation in at least one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
8.	Exhaust gas system details:	*Technical extract/ *paper letter/ *email/ *Drwaing from user or *contract docu ment or *scheme or *any document in public domain enclosed at annexure. to Attachment-3K
9.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure. to Attachment-3K

10. Performance details:

*Certificate/*Letter/*E-mail from End user enclosed at Annexure.... to Attachment-3K

* **Strike off whichever is not applicable.**

H. Fuel Oil system (Not Applicable): We declare that, we/our Sub-Vendor, have designed, *manufactured/*got manufactured and supplied and commissioned at least one(1) number fuel oil handling and storage installations, which should have been in successful operation for minimum one (1) year consisting of:

- i) Fuel oil decanting facilities for road tankers/railway wagons.
- ii) Fuel Oil Storage tanks of capacity not less than 500 cubic meters.

The experience as at (i) and (ii) above in separate installations is also permissible.

(Supply of steel plates for fabrication of tanks for the above reference installation(s) should also have been under the scope of the bidder).

Sl. No. Description Reference Work

- 1. Name of the reference plant & location:
- 2. Client name and his address:
- 3. No. of units and capacity in MW of unit:

4. Name of equipment manufacturer & address:
5. Date of commission of the equipment:
6. Model no. of the equipment:
7. Brief Technical particulars of the equipment:
8. Capacity-
9. Whether the equipment(s) are in successful operation in at least one(01) plant for a period not less than one (01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder
- *Yes/*No
10. Fuel oil system details: *Technical extract/ *paper letter/ *email/ *Drwaing from user or *contract docu ment or *scheme or *any document in public domain enclosed at annexure. to Attachment-3K
11. Scope of Work: *Letter of Award or *Contract or *P.O. enclosed at Annexure. to Attachment-3K
12. Performance details: *Certificate/*Letter/*E-mail from End user enclosed at Annexure.... to Attachment-3K

* **Strike off whichever is not applicable.**

I. Fire Detection and Protection system: We declare that we/our Sub-Vendor have designed, supplied, erected and commissioned at least one (1) fire protection systems, each of Contract value not less Rs.35.0 million or equivalent in foreign currency (exchange rate applicable as on date of techno commercial bid opening), in industrial installations. The above fire protection systems comprised of :-

- a) Fire hydrant system
- b) High velocity water (HVW) spray or medium velocity water (MVW) spray or sprinkler system.
- c) Fire water pumping and pressurizing arrangement.

We further declare that the systems mentioned above have been designed to the recommendations of *Tariff Advisory Committee of India or Oil Industry Safety Directorate (OISD) or any other International reputed authority (like LPC-U.K. or NFPA - USA) and this system have been in successful operation for a period of not less than one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project package. The details of Fire Detection and Protection system executed by us are furnished below. In addition, the analogue addressable type fire alarm system proposed shall be sourced from a firm who has supplied at least one (1) similar system which has been approved or listed by UL-USA/ FM-USA / LPC-UK/ similar agency and have been in operation for at least one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project package. Further, the inert gas fire extinguishing system shall be sourced from agency who has designed and supplied at least one (1) inert gas total flooding fire extinguishing system each having a total risk volume of at least 500 cum. This system have been designed to the recommendation of Tariff advisory committee of India or any other international reputed authority (like LPC-UK or NFPA, USA) and have been in operating condition for a period not less than one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project package

Details pertaining to Technical Qualification of the Bidder

(To be filled up for contracts having order value not less than Rs. 35.0 million or equivalent)

Sl. No. Item Description

1. Client name and address
2. Name and Address of the plant/installation
3. Fire detection and protection system executed is for industrial installation

(Yes / No)

4. Date of order
5. Date from which the system is in operating condition
6. Value of the order in Rs. Million
7. The Scope included :
 - (a) Design (Yes / No)
 - (b) Supply (Yes / No)
 - (c) Erection (Yes / No)
 - (d) Commissioning (Yes / No)
8. The fire protection system has been designed as per TAC/NFPA/OISD/LPC/any other International reputed authority
(Please indicate the name of the authority) (Yes / No)
9. The above contract included :
 - (a) Fire Hydrant system
(Yes / No)
 - (b) High velocity water spray (HVW) system
(Yes / No)
 - (c) Medium velocity water spray (MVW) System
(Yes / No)
 - (d) Sprinkler System
(Yes / No)

- (e) Fire water pumping and
pressurizing arrangement
(Yes / No)
- 10. Documentary evidence/certificate from client in support of above is enclosed
(yes/No).

We further confirm that notwithstanding anything stated above, the Employer reserves the right to assess our/our collaborator's / our Associate's/ our subsidiaries/ our Group Companies to perform the contract , should the circumstances warrant such assessment in the overall interest of the Employer in line with QR requirement at item no.....

* **Strike off whichever is not applicable.**

J. Compressed Air system: We declare that, we/our Sub-Vendor, have designed, manufactured, supplied, erected/supervised erection and commissioned/supervised commissioning at least one (1) number non-lubricated oil free screw type air compressor of minimum capacity 10 NM3/min at rated discharge pressure of 8 kg/cm² (g) which have been in successful operation for at least one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project package.

The Air Drying Plant (A.D.P) has been supplied from such manufacturers who have manufactured and supplied at least one (1) number Air Drying Plant of capacity 10 Nm3/min or more and the type same as offered, which should have been in successful operation.

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit: in coal fired power plant	

6. Name of equipment manufacturer & address:
7. Date of commission of the equipment:
8. Model no. of the equipment:
9. Brief Technical particulars of the equipment:
10. Capacity-
11. Whether the equipment(s) are in successful operation in atleast one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder
- *Yes/*No
12. Compressed Air System details: *Technical extract/ *paper letter/ *email/ *Drwaing from user or *contract document or *scheme or *any document in public domain enclosed at annexure. to Attachment-3K
13. Scope of Work: *Letter of Award or *Contract or *P.O. enclosed at Annexure. to Attachment-3K
14. Performance details: *Certificate/*Letter/*E-mail from End user enclosed at Annexure.... to Attachment-3K
-

*** Strike off whichever is not applicable.**

2.00.00 PROVENNESS DATA FOR ELECTRICAL EQUIPMENTS

2.01.00 Details of Provenness of the offered generator as per clause no. 15.05.01, volume-IV, Part-A, Section-VI of Bidding Document

**Reference
Generator** **Offered
Generator**

- (a) Name of the Station and its Location
- (b) Client Name and its Address,
Fax and Tel. No.
- (c) Name and Designation of the
responsible person in Client's
Organization
- (d) Contract No. & Date
- (e) Date of commissioning
- (f) Date of commencement
of successful operation
- (g) Generator Make
- (h) Model No.

- (i) MVA Rating
- (j) MW Rating
- (k) Rated Voltage
- (n) Thermal Class of Insulation
 - (i) Stator
 - (ii) Rotor
- (o) Type of Cooling
- (p) Type of Excitation System
- (q) Reference Standard
- (s) Latest/recent certificate from client that the generator with above technical parameters is in successful operation in at least one (1) plant for a period not less than one (1) year on or before Six (6) months after award date of Andaman & Nicobar Gas Power project

package (actual time period to
be mentioned) and caused
no serious problem in past, is
enclosed at Annexure....
to this Attachment-3K

Date : (Signature).....

(Designation).....

Place : (Printed Name).....

(Common seal).....

3.00.00 PROVENNESS DATA FOR SOLAR PV ROOFTOP

3.01.00 FOR SOLAR PV ROOFTOP EPC CONTRACTOR

(A) For Bidder or its Sub-vendor seeking qualifications as per clause 15.06.01 of volume-IV, Part-A, Section-VI of technical specification

We confirm that we/ our Sub vendor have designed, supplied, erected/ supervised erection and commissioned/ supervised commissioning of Solar Photo Voltaic (SPV) based grid connected power plant of one plant of 40 kWp or above.

We further confirm that reference plant of 40 kWp or above capacity has been in successful operation for at least six (6) months prior to the date of Techno Commercial Bid opening.

(I) Details of SPV based grid connected power plant of installed capacity of 40 kWp or above as per following details: Installed capacity of Grid connected power plant in Kwp -

Sl. No.	Item Description	Reference Plant 1 (40 kWp or above)
1.	Description of work	
2.	Name of Client with full address, Fax No. & Tel. No.	
3.	Name of the Power Plant with its location	
4.	Name and designation of the responsible person in client's organization	
5.	Contract No. and Date	
6.	Whether this is a SPV based grid connected Power Plant	YES*/NO*
7.	Capacity of the Plant	kWp
8.	Whether scope of works included	
	(a) Design	YES*/NO*
	(b) Supply	YES*/NO*
	(c) Erected	YES*/NO*
	(d) Supervised Erection	YES*/NO*
	(e) Commissioned	YES*/NO*

(f) Supervised Commissioning YES*/NO*

YES*/NO*

9. Date of Commissioning of the above Plant
10. Copies of authentic purchase orders Completion Certificate from client, Agreements in support of details/data of Sl. No. 1 to 9 enclosed as Annex.

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

(II) Details of reference plant of 40 kWp or above capacity has been in successful operation for at least six (6) months as per following :

Sl. No.	Item Description	Reference Plant
1.0	Description of work	
2.0	Name of Client with full address, Fax No. & Tel. No.	
3.0	Name of the Power Plant with its location	
4.0	Name and designation of the responsible person in client's organization	
5.0	Contract No. and Date	
6.0	Whether this is a SPV based grid connected Power Plant	YES*/NO*

7.0	Capacity of the Plant	kWp
8.0	Whether scope of works included	
	(a) Design	YES*/NO*
	(b) Supply	YES*/NO*
	(c) Erected	YES*/NO*
	(d) Supervised Erection	YES*/NO*
	(e) Commissioned	YES*/NO*
	(f) Supervised Commissioning	YES*/NO*
9.0	Date of Commissioning of the above Plant	
10.0	No. of months of successful operation of the above plant prior to the date of Techno- Commercial bid opening date.	
11.0	Completion Certificate from client, Copies of Authentic purchase orders, Agreements in support of data/details of Sl. No. 1 to 10 enclosed as Annex.	

Note: Continuation sheets of like size and format may be used and annexed to this Attachment if required.

3.02.0 FOR SOLAR PV MODULE OF APPROVED QR

(A) For bidder or its Sub-vendor seeking qualifications as per clause 15.06.02 of Volume-IV, Part-A, Section-VI of Technical specification

(I) LIST OF SOLAR PLANTS OF CUMULATIVE INSTALLED CAPACITY 1 MWp or above IN WHICH SOLAR PV MODULES HAVE BEEN MANUFACTURED AND SUPPLIED DURING ANY ONE FINANCIAL YEAR.

NAME OF BIDDER/ SUB-VENDOR -

SL. No.	FINANCIAL YEAR	PROJECT LOCATION , CAPACITY, NAME OF CLIENT	DATE OF AWARD	APPROX CONTRACT VALUE(Rs)	KWp / MWp of MODULES SUPPLIED DURING THE FINANCIAL YEAR
1.0					
2.0					

The Bidder or its Sub-vendor should enclose client certificate/and/or copy of Letter of Award in respect of above

(II) LIST OF SOLAR PLANTS IN SUCCESSFUL OPERATION FOR AT LEAST 6 MONTHS PRIOR TO TECHNO COMMERCIAL BID OPENING IN WHICH SOLAR PV MODULES HAVE BEEN MANUFACTURED AND SUPPLIED OF 300 Wp or above USING INDIGENOUS OR IMPORTED PV CELLS .

NAME OF BIDDER/ SUB-VENDOR -

SL. No.	PROJECT LOCATION, CAPACITY, NAME OF CLIENT	DATE OF AWARD	APPROX CONTRACT VALUE	(>) 200 Wp MODULES SUPPLIED (Y/N)	DATE OF COMMISSIONING OF THE PROJECT
1.0					
2.0					

The Bidder or its Sub-vendor should enclose client certificate in respect of above.

The works referred to at clause (I) & (II) can be in same or different projects.

*** Strike off whichever is not applicable.**

**** Add more agencies if proposed.**

ATTACHMENT 4

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 34, Noida - 201301, India

BIDDER TO ATTACH DOCUMENTARY EVIDENCE ESTABLISHING IN ACCORDANCE WITH CL. NO. 2.0 (d) OF BID FORM THAT THE FACILITIES OFFERED ARE ELIGIBLE FACILITIES AND CONFORM TO THE BIDDING DOCUMENTS.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(List of Special Maintenance Tools & Tackles)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sir,

We are furnishing below the list of special maintenance tools & tackles for various equipment under the subject package. The prices for these tools & tackles are already included in the lump sum bid price. We further confirm that the list of Special Maintenance tools & tackles includes all the items specifically mentioned in scope of supply & services covered in Section- VI, Technical Specification of Bidding Document.

Notwithstanding what is stated above we further confirm that any additional special maintenance tools and tackles required for the equipment supplied under this package shall be furnished by us at no extra cost to the Employer.

S.No.	Description of Equipment	Description of Tools & Tackles	Unit	Qty.
-------	--------------------------	--------------------------------	------	------

----- Date :

(Designation).....

Place : (Printed Name).....

Note : Continuation Sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Details of Proposed Sub-contractors/Sub-Vendors)**

Bidder's Name and Address:

To
NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sirs,

The details of all items of services or supply which we propose to sublet, giving details of the name and nationality of the proposed Sub-Contractor/Sub Vendor for each item, are given in Annexure- I to this Attachment - 5.

Date : (Designation).....

Place : (Printed Name).....

- Note :
1. Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.
 2. Bidder shall attach letters of intent with the Sub-Contractor (Sub-vendors so as to confirm their participation).
 3. Bidder may also propose sub-vendors from the " Indicative Vendor List" attached at Section VI.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Details in respect of Local Agent)

Bidder's Name and Address: To NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sir,

We furnish below the following information in respect of our Local Agent:

(i) Name and Address of the Local Agent

.....
.....
.....

(ii) Services to be rendered by the Local Agent

.....
.....
.....

Date : (Signature).....
Place : (Printed Name).....
(Designation).....
(Common Seal).....

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Declaration on Demonstration Parameter)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sir,

We declare that the ratings, capacities and performance figures of the equipment/system furnished by us under this package are to be demonstrated by us. We further declare that in the event of any deficiencies in meeting the following parameters in respect of the characteristics mentioned below as established after conducting the guarantee test, you may at your discretion reject the equipment/system and recover payment already made or accept it after assessing the deficiency and effecting recovery from the contract price as specified in Part-A, Section-VI (Technical Specification) of bidding document.

<p>1. Net Heat Rate</p> <p>(i) Net Heat Rate at 100% of Engine load</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	<p>To be filled and submitted in attachment-3P of Price Bid Form with Price bid</p>
<p>2. NET Power Output at Base/Full Load</p> <p>(i) Net Power Output of each Genset in kW. (ii) No. of Identical Engines offered (iii) Total Net Power Output for the Power Plant</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	<p>To be filled here</p>
<p>3. NO_x Emission Level</p> <p>(i) We Confirm NO_x emission level of less than 80 ppm (dry volume basis corresponding to 15% excess oxygen in Engine exhaust) while operating at 100%, 90%,80%,70%,60% & 50% of Base Load Output</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	<p style="text-align: center;"><u>Yes/No</u></p>

<p>4. Noise</p> <p>We Confirm The noise levels shall meet the MoEF&CC guidelines as enclosed at Annexure-I of Volume-IV, Part-A, Section-VI.</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	<p><u>Yes/No</u></p>
<p>5. Plant Effluent Quality and Quantity.</p> <p>We Confirm All liquid effluents emanating out of the power plant shall be treated (as required) to meet the Environmental Standards for Gas Naphtha-based Thermal Power Plants published by MOEF vide notification dated 22.12.1998 and General Standard for Discharge of Environment Pollutants, Part-A: Effluents Published by MOEF dated 19.05.93 & also the latest MoEF&CC notification for discharge standards for effluents dated 13.10.2017 under E(P) Rules & its amendment thereof, applicable for discharge in Inland Surface Waters, whichever are more stringent.</p> <p>The discharge standards to be followed are enclosed at Annexure-II (A) & Annexure-II (B) of Volume-IV Part-A, Section-VI.</p> <p>The treated effluents shall also meet quality requirements of CPCB, if more stringent than the standard mentioned in technical specifications.</p> <p>As per clause 6.03.02 of Volume-IV, Part-A, Section-VI Devices for measurement of pH, Turbidity, Conductivity, and Flow at the point of liquid effluent discharge out of the plant shall be installed.</p> <p>We confirm to meet effluent quality & quantity parameters as specified in Chapter-M3 of Volume-I, Part-B, Section-VI.</p>	<p><u>Yes/No</u></p>
<p>6. Plant Auxiliaries</p> <p>Demonstration parameters as per Clause 1.04.03 of Section-VI, Part-A, Volume-V, Guarantee Requirements</p>	<p><u>Confirm/Not Confirm</u></p>

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common Seal).....

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25**

**Schedule of Erection Tools & Equipment and Safety Equipment &
Safety Personal Protective Equipment**

A Erection Tools & Equipment

We indicate herein below the minimum T & P we have in our/our associate's/sub vendor's possession and the equipment we propose to bring to the Site required for entire EPC Package, in case the contract is awarded to us.

Bidders are required to provide the list of such required / necessary plant/equipment/machinery as per their proven practice in the bid and to ensure completion of the project in time.

Sl. No.	Type and Description of the Equipment	Indicative minimum Quantity of major T&P to be deployed	Number the Bidder has in Possession	Number the Bidder proposes to bring to the site
1.				
2.				
3.				
4.				
5.				
6.				
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41.				

We hereby confirm that the quantity and type of Certain tools and equipment, we will employ for construction/erection, will not be less than those listed above and agree to bring more equipment, if so warranted, in the opinion of the Project Manager. Our proposed construction/erection equipment utilization plan indicating utilization dates and time duration of all major erection and construction equipment placed on site is enclosed at Annexure to this attachment.

We have enclosed construction and erection philosophy including sequence of erection and construction, implementation methodology, deployment schedule of tools and plant to be brought to site for construction/ erection work under the subject package at Annexure. to this attachment of Techno-Commercial Bid, linked with major Milestone and intermediate milestone for Main Plant and Balance of Plant. We have also enclosed network showing interlink age between major milestones, tool and plants deployed and sequential supply of material for the subject package.

B. Safety Equipment & Safety Personal Protective Equipment

The list of minimum suggestive **Safety Equipment & Safety Personal Protective Equipment** we propose to bring to the Site, in case the contract is awarded to us is indicated below:

SI. No.	Minimum Suggested List of Safety Equipment and Safety Personal Protective Equipment	Minimum Quantity
1.	<p>Safety Net (Conforming IS 11057:1984)</p> <p>Safety Net (Net Size: 10m x 5m, Mesh Size: 25 mm, Mesh Rope: 2mm double cord, Border/Tie Cord: 12mm diameter polypropylene rope (tested as per IS: 5175).Two metres length shall be provided at all four corners.</p>	25 Nos.
2.	<p>Fall Arrester 'Rope grab fall arrester' & anchorage line.</p> <p>Anchorage Line: 14mm- 16 mm diameter, three strand twisted Polyamide rope.</p> <p>Rope Grab fall arrester: Openable & Guided type Fall Arrestor (on flexible line) conforming EN 353-2 & works on 14-16 mm diameter polyamide rope. material: Nickel Chrome plated Steel Connector: Karbiner conforming to EN 362 (Minimum Strength 22 KN), material: Steel</p>	<p>30 Nos. of „Rope Grab Fall arrester“ and Karbiner each.</p> <p>10 Nos. of anchorage line, each 30 metre long.</p>
3.	<p>Horizontal life line</p> <p>Stainless Steel Wire rope of 8mm diameter. Minimum six nos. of steel U-bolt clips are required for clamping each wire rope to a rigid support (03 nos. of U-bolt clips at each end).</p>	20 Nos. of wire rope, each 40 metre long.
4.	<p>Ladders on column</p> <p>The minimum design live load on metallic ladder shall be a single concentrated load of 100 kilo grams. All rungs shall have a minimum diameter of 1.90 centimeters, and minimum clear length of rungs shall be 40.6 centimeters. The distance between rungs shall not exceed 30.5 centimeters. Each ladder shall have maximum height of 9.0 metre.</p> <p>The ladder shall have proper fastenings for attaching it to a column using positive means such as bolt, weld or other type of fasteners.</p>	cumulative length of ladders is 100 metres
5.	<p>Safety PPEs (Industrial Safety helmet & Industrial Safety Shoes)</p> <p>Industrial Safety Helmet (IS:2925-1984 marked). Industrial Safety/Electrical Shoes (IS:15298-2002 marked). Full body Safety Harness (conforming IS:3521)</p>	<p>100 nos.</p> <p>100 nos.</p> <p>30 nos.</p>

We hereby confirm that the quantity and type of equipment, we will employ for construction/erection, will not be less than those listed above and agree to bring more equipment, if so warranted, in the opinion of the Project Manager.

Note : Continuation sheets of like size and format may be used as per Bidder's requirements and shall be annexed to this Attachment.

Date : (Designation).....
Place : (Printed Name).....

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(List of Commissioning / Start-up Spares)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex, A-8A,
Sector 24, Noida - 201301, India

Dear Sir,

We indicate herein below the list of Commissioning/ Start-up Spares for **ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)**:

Sl. No.	Item Description	Unit	Quantity
(1)	(2)	(3)	(4)

We note that the above list is subject to your approval and we shall ensure the availability of the required quantity of Commissioning spares as approved by you without any additional cost to you before start-up/initial operation.

Date:

(Signature)

Place:

(Printed Name)

(Designation)

(Common Seal)

Note: Continuation sheets of like size and format may be used as per Bidder's requirements and shall be annexed to this Attachment.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Technical Data Sheet)**

Attachment 10 is as per TECHNICAL SPECIFICATION, SECTION-VI. Bidder is required to fill in the Technical Data as per the Clause 7.00.00 of Chapter-M1, Volume-I, Part-B of TECHNICAL SPECIFICATION, SECTION-VI and submit the same along with bid.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Information regarding Quality Assurance Programme)

Bidder's Name and Address:

TO
NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex, A-8A,
Sector 24, Noida - 201301, India

Dear Sirs,

We hereby provide the necessary information on Quality Assurance Program containing the overall Quality Management and procedures, which we propose to follow during various phases of execution of the Contract.

----- Date :

(Designation).....

Place : (Printed Name).....

...

Note : Continuation sheets of like size and format, may be used as per Bidder's requirement and shall be annexed to this Attachment.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Additional Information included with the proposal)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office
Complex, A-8A, Sector 24, Noida -
201301, India

Dear Sirs,

Sl. No.	Description of Information	Reference to Bidding documents	Reference to Bid Proposal
---------	----------------------------	--------------------------------	---------------------------

----- Date :

(Designation).....

Place : (Printed Name).....

Note : Continuation sheets of like size and format may be used as per Bidder's requirements and annexed to this Attachment.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Milestone Schedule)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex, A-8A,
Sector 24, Noida - 201301, India

Dear Sirs,

We declare that following program of furnishing, erecting, testing, commissioning, and completion of facilities covered under the package shall be followed by us:

Sl.	Description of Area/ Major Milestones	Duration in months from NOA	
		Start	Finish
1.	Basic Engineering	00	04
2.	Detailed Engineering	-	09
3.	Completion of Ordering of BOIs (Bought out Items)	-	06
4.	Commencement of Manufacturing	05	-
5.	Supply of Materials	08	20
6.	Establishment of Site Office, Storage Facilities & Mobilisation	-	06
7.	Equipment Erection Works* (Mechanical, Electrical, C&I)	09	24
8.	Progressive Commissioning of Gas Engine Modules	24	26
9.	Completion of Facilities	-	28
10.	Supply of Mandatory Spares	-	22

Note:

1. "Start" in each activity means next day after the lapse of duration given from NOA, however, in case of "Start=0" the start date will be the date of NOA.
2. "Finish" means last day of completion of the period of particular activity.

Integrated Network:

The bidder shall be required to submit a brief integrated network (L 1 schedule) in line with the major milestone chart given above. The network shall be prepared and submitted in Primavera I MS Project format showing all inter activity relationships. A soft copy of the same also may be furnished. Further, the L 1 schedule shall, inter-alia, include at least following activities for each systems listed below, showing their inter-relationships between engineering, supply and site execution:

Milestones to be incorporated in L 1 network to be submitted with bid

- 1. Ordering on sub vendor (wherever applicable)
- 2. Start of engineering
- 3. Completion of engineering
- 4. Start of manufacturing/fabrication
- 5. Completion of manufacturing/fabrication
- 6. Readiness and completion of Type Test
- 7. Commencement of Supplies
- 8. Completion of supplies of all items
- 9. Completion of site delivery of mandatory spares.
- 10. Start of Erection
- 11. Completion of Erection
- 12. Testing and commissioning of the System
- 13. Completion of the Facilities

Date : (Designation).....
Place : (Printed Name).....

I/We hereby declare that the particulars given above are correct and complete. If the transaction is delayed or credit is not affected at all for reasons of incomplete or incorrect information, I/We would not hold the Employer responsible.

SIGNATURE

DATE

--	--	--	--	--	--

(AUTHORISED SIGNATORY)

Name

:

OFFICIAL STAMP

BANK CERTIFICATION:

It is certified that above mentioned beneficiary holds a bank account no.
with our branch and the Bank particulars mentioned above are correct.

NAME:

SIGNATURE:

OFFICIAL STAMP

(AUTHORISED SIGNATORY)

Authorization No. :

DATE					

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25**

(INTEGRITY PACT)

Between

NTPC VIDYUT VYAPAR NIGAM LIMITED., a wholly owned subsidiary of NTPC Ltd. (hereinafter referred

to as "The Employer") and

..... (Hereinafter referred to as "The Bidder/Contractor") and

..... (Hereinafter referred to as "JV Partner/ Consortium
Members")

(if applicable)

Preamble

The Employer invites the bids from all eligible bidders and intends to enter into contract for **ANDMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)** with the successful bidder(s), as per organizational systems and procedures. The Employer values full compliance with all relevant laws and regulations, and the principles of economical use of resources, and of fairness and transparency in its relations with its Bidder(s) and/or Contractor(s).

In order to achieve these goals, the Employer may appoint an Independent External Monitor (IEM), who will monitor the bidding process and the execution of the contract for compliance with the principles mentioned above.

Section 1 Commitments of the Employer

1. The Employer commits itself to take all measures necessary to prevent corruption and to observe the following principles in this regard:
 - a) No employee of the Employer, either in person or through family members including relatives, will in connection with the bidding for or the execution of a contract, demand or accept a promise for or accept for him/herself or for a third person, any material or immaterial benefit to which he/she is not legally entitled to.
 - b) The Employer shall, during the bidding process treat all Bidders with equity and reason. The Employer will, in particular, before and during the bidding process, provide to all Bidders the same information and will not provide to any Bidder confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the bidding process or the contract execution.
 - c) The Employer will exclude from the process all known prejudiced persons.
2. If the Employer obtains information on the conduct of any of its employees which is a criminal offence under the IPC/PC Act or if there be a substantive suspicion in this regard, the Employer will inform the Chief Vigilance Officer and in addition

can initiate disciplinary actions.

Section 2 Commitments and Undertakings by the Bidder/Contractor

- 1 The Bidder/Contractor commits and undertakes to take all measures necessary to prevent malpractices & corruption. He commits himself to observe the following principles during his participation in the bidding process and during the execution of the contract:
 - a) The Bidder/ Contractor undertakes not to, directly or through any other person or firm offer, promise or give or influence to any employee of the Employer associated with the bidding process or the execution of the contract or to any third person on their behalf any material or immaterial benefit which he/she is not legally entitled, in order to obtain in exchange any advantage of any kind whatsoever during the bidding process or during the execution of the contract.
 - b) The Bidder/ Contractor undertake not to enter into any undisclosed agreement or understanding, whether formal or informal with other Bidders. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other action to restrict competitiveness or to introduce cartelization in the bidding process.
 - c) The Bidder/Contractor undertakes not to commit any offence under the relevant Anti-corruption Laws of India; further the Bidder/Contractor will not use improperly, any information or document provided by the Employer as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically for purposes of competition or personal gain and will not pass the information so acquired on to others.
 - d) The Bidder/ Contractor will, when presenting his bid undertakes, to disclose any and all payments made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2 The Bidder/ Contractor will not instigate and allure third persons/parties to commit offences outlined above or be an accessory to such offences.

Section 3 Disqualification from Bidding Process and Exclusion from Future Contracts If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of any provisions of Section 2 or in any other form so as to put his reliability or credibility as Bidder into question, the Employer shall be entitled to disqualify the Bidder(s)/ Contractor(s) from the bidding process or to terminate the contract, if signed on that ground.

1. If the Bidder/ Contractor has committed a transgression through a violation of Section 2 such as to put his reliability or credibility into question, the Employer shall be entitled to exclude including blacklist and put on holiday the Bidder/

Contractor for any future tenders/contract award process. The imposition and duration of the exclusion will be determined by the severity of the transgression. The severity will be determined by the Employer taking into consideration the full facts and circumstances of each case particularly taking into account the number of transgressions, the position of the transgressors within the company hierarchy of the Bidder and the amount of the damage. The exclusion will be imposed for a minimum of 3 years.

2. A transgression is considered to have occurred if the Employer after due consideration of the available evidence concludes that no reasonable doubt is possible.
3. The Bidder with its free consent and without any influence agrees and undertakes to respect and uphold the Employer's absolute rights to resort to and impose such exclusion and further accepts and undertakes not to challenge or question such exclusion on any ground, including the lack of any hearing before the decision to resort to such exclusion is taken. This undertaking is given freely and after obtaining independent legal advice.
4. Subject to full satisfaction of the Employer, the exclusion of Bidder/ Contractor could be revoked by the Employer if the Bidder/ Contractor can prove that he has restored/ recouped the damage caused by him and has installed a suitable corruption prevention system in his organization.

Section 4 Compensation for Damages including Forfeiture of Earnest Money Deposit/ Security Deposit/ Performance & Advance Bank Guarantees

1. If the Employer has disqualified the Bidder/ Contractor from the bidding process or has terminated the contract pursuant to Section 3, the Employer shall forfeit the Earnest Money Deposit/Bid Security, encash Contract Performance Bank Guarantees in addition to excluding the bidder from the future award process and terminating the contract.
2. In addition to 1 above, the Employer shall be entitled to take recourse to the relevant provisions of the contract related to Termination of Contract due to Contractor's Default.

Section 5 Previous Transgressions

1. The Bidder swears on oath that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other Company in any country conforming to TI approach or including with any Public Sector Enterprise/ Undertaking in India or any Government Department in India that could justify bidder's exclusion from the tender process.
2. If the Bidder makes incorrect statement on this subject, Bidder can be disqualified from the bidding process or the contract, if already awarded, can be terminated on this ground.

Section 6 Company Code of Conduct

Bidders are also advised to have a company code of conduct (clearly rejecting the use of

bribes and other unethical behaviour) and a compliance program for the implementation of the code of conduct throughout the company.

Section 7 Deleted

Section 8 Pact

Duration

This Pact comes into force from the date of signing by all the parties. It shall expire for the Contractor 12 months after the last payment under the respective contract, and for all other unsuccessful bidders 6 months after the contract has been awarded.

Section 9 Miscellaneous Provisions

- 1 This Pact is subject to Indian Law. The place of performance and jurisdiction shall be New Delhi.
- 2 Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
3. The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.
4. If the Contractor is a JV partnership / Consortium / Associate, this agreement must be signed by all the partners of JV / Consortium Partners / Associate as the case may be.

The Parties hereby sign this Integrity Pact aton thisday of 2020.

Employer

Bidder/ Contractor

Joint Venture Partner(s)/
Consortium members

Witness

Witness

Witness

1. _____

1. _____

1. _____

2. _____

2. _____

2. _____

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Declaration on Local Content)**

Dear Sirs,

We have read the provisions of "Preference to Make in India and granting of purchase preference to local suppliers" enclosed with the Bid Data Sheets. In terms of the requirement of the aforesaid provisions, we hereby declare the following:

1.0* In order to avail purchase preference, we confirm that we are a 'Class-I local Supplier' as per details given below:

Sl. no.	Description of Goods & Services	Details of the location(s) at which the local value addition is made

OR

1.0* We confirm that we are not a 'Class-I local Supplier'

*Bidder to Strike off, whichever is not applicable.

1.1 **We undertake that a certificate from the statutory auditor or cost auditor (in the case the bidder is a company) or from a practicing cost accountant or practicing chartered accountant (in respect of bidders other than companies) certifying the percentage of local content shall be submitted by us prior to submission of our last bill for payment.**

2.0 Further, we hereby confirm the following:

Whether the bidder is presently debarred/ banned by any other procuring entity for violation of 'Public Procurement (Preference to Make in India), Order 2017' (PPP-MII Order) dated 15.06.2017 issued by Department of Industrial Policy and Promotion (DIPP) AND DPIIT CIRCULAR DTD 04.06.2020	Yes/No
--	--------

3.0 We agree to furnish any information as a proof of the above to your satisfaction as and when required.

Note: 1) Continuation sheets of like size and format may be used as per Bidders requirements and shall be annexed to this Attachment.
2) **In case a bidder does not submit the aforesaid declaration or no value is indicated by the bidder or statement/any declaration like 'later', 'to be furnished later', 'NA' etc. are indicated by the bidder against value/percentage of local content, then the bidder shall not be considered as a local supplier and shall not be eligible for any purchase preference.**

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Information regarding Safety Management)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sirs,

We have read the provisions pertaining to Safety and hereby undertake to comply all the provisions of Bidding Documents in this regard.

We hereby confirm that all the measures to ensure highest level of Safety during execution at Site shall be taken by us.

Further, in terms of the provisions of Clause No. 44.00.00, Volume-VII of Technical Specification (Section-VI) of Bidding Documents, a proposed "Safety Plan" is attached herewith as Appendix-I to this Attachment.

A "Safety Co-ordination Procedure" shall be finalized during post bid discussions of Techno-Commercial Bid.

The above proposed "Safety Plan" shall be further discussed/ finalized at Site, in line with the agreements made in "Safety Co-ordination Procedure", and shall be approved by Project Manager/Engineer-In-Charge/ Head of Project before start of work at Site.

Date: (Signature).....

Place: (Printed Name)

(Designation)

(Company Seal)

Note: Continuation sheets of like size and format, may be used as per Bidder's requirement and shall be annexed to this Attachment.

SAFETY PLAN

- 1. Safety Policy of the Contractor to be enclosed:**
2. When was the Safety Policy last reviewed:
3. Details of implementation procedure / methods to implement Safety Policy /Safety Rules:
4. Name, Qualification, experience of Safety Officer
5. Review of Accidents Analysis Method, Methods to ensure Safety and Health:
6. Unit executive responsible to ensure Safety at various levels in work area:
7. List of employees trained in safety employed before execution of the job. Give the details of training:
8. Safety Training Targets, Schedules, methods Adopting to providing safety training to all employee:
9. Details of checklist for different jobs / work and responsible person to ensure compliance (copy of checklist to be enclosed):
10. Regular Safety Inspection Methods and Periodicity and list of members to be enclosed:
11. Risk Assessment, Safety Audit by Professional Agencies, Periodicity:
12. Implementation of Recommendations of Audit / Inspections, Procedures for Implementation and follow up:
13. Provision for treatment of injured persons at work site:
14. Review of overall safety by top Management and Periodicity:
15. System for Implementation of Statutory legislations:
16. Issue of PPEs to employees, Periodicity / stock on hand etc.:
17. Specify safety measures for round the clock working (especially during night):

Signature
Head of the Organization
With date & Stamp

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(CHECKLIST FOR TECHNO-COMMERCIAL BID)**

Bidder's Name and Address:

To

NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
A-8A, Sector 24, Noida - 201301, India

Dear Sirs,

Check List of documents to be submitted for Techno-Commercial Bid

Sl.	Details of Checks	Enclosed: Yes / No
1.	BID FORM (TECHNO-COMMERCIAL BID)	.....
2.	ATTACHMENT-1, 1A, 1B (IN A SEPARATELY SEALED ENVELOPE)	.....
3.	ATTACHMENT-2 (IN A SEPARATELY SEALED ENVELOPE)	.....
4.	ATTACHMENT-3 (INCLUDING QR DETAILS)	.....
5.	ATTACHMENT-4 & 4A	.....
6.	ATTACHMENT-5	.....
7.	ATTACHMENT-7	.....
8.	ATTACHMENT-8	.....
10.	ATTACHMENT-9	.....
11.	ATTACHMENT-9A	.....
12.	ATTACHMENT-10	.....
13.	ATTACHMENT-12	.....
14.	ATTACHMENT-13	.....
15.	ATTACHMENT-14	.....

Sl.	Details of Checks	Enclosed: Yes / No
16.	ATTACHMENT-15	.....
17.	ATTACHMENT-16	Accepted Through GTE
18.	ATTACHMENT-17	.....
19.	ATTACHMENT -18	.....
20.	SIGNED AND STAMPED COPY OF AMENDMENT(S)/CLARIFICATION(S)/ ERRATA TO BIDDING DOCUMENTS.	.....

Date : (Designation).....

Place : (Printed Name).....



SECTION - VII (Part 2 OF 3)

FORMS AND PROCEDURES

FOR

ANDAMAN & NICOBAR

GAS ENGINE POWER PROJECT (50 MW)

IFB DOCUMENT NO.: NVVN/C&M/RE-333/2024-25

(This document is meant for the exclusive purpose of bidding against this Bid Document No. / Specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

1B. BID FORM AND ATTACHMENTS

ENVELOPE-II (PRICE BID)

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
DOCUMENT NO. NVVN/C&M/RE-333/2024-25**

**BID FORM
ENVELOPE-II (PRICE BID)**

Ref No.:

Date:

IFB No. : NVVN/C&M/RE-333/2024-25

**Name of Package : ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
DOCUMENT NO. NVVN/C&M/RE-333/2024-25**

To
NTPC VIDYUT VYAPAR NIGAM LIMITED,
5th Floor, Engineering Office Complex,
Plot A-8A, Sector 24, Noida-201301,
Distt. Gautam Budh Nagar, State of U.P., India

Gentlemen and/or Ladies,

1.0 Having examined the **Bidding Documents No. NVVN/C&M/RE-333/2024-25**, including subsequent amendments and clarifications if any, the receipt of which is hereby acknowledged, we the undersigned, offer to design, manufacture, test, deliver, construct, install and commission (including carrying out Guarantee Test) the facilities under the above-named Contract in full conformity with the said Bidding Documents for the sum as mentioned in Bid invitation at e-tendering portal or such other sums as may be determined in accordance with the terms and conditions of the Contract.

1.1. We further understand that discount letter, if any, separately uploaded online or submitted in physical form shall not be considered for the purpose of evaluation.

2.0 COMPLIANCE TO THE PROVISIONS OF THE BIDDING DOCUMENTS

2.1 We have read all the provisions of the Bidding Documents and confirm that notwithstanding anything stated anywhere in our bid to the contrary, the provisions of the Bidding Documents, are acceptable to us and we further confirm that we have not taken any deviation to the provisions of the Bidding Documents anywhere in our bid.

Any deviation, variation or additional condition etc. or any mention, contrary to the provisions of Bidding Documents and its subsequent Amendment(s)/ Clarification(s)/Addenda/Errata (if any) found anywhere in our bid proposal, implicit or explicit shall stand unconditionally withdrawn, without any cost implication whatsoever to the Employer, failing which our bid shall be rejected and our Bid Security shall be forfeited.

2.2 We further declare that additional conditions, variations, deviations, if any, found anywhere in the proposal, shall not be given effect to.

3.0 We are aware that the BOQ/Price Schedules do not generally give a full description of the work to be performed under each item and we shall be deemed to have read the Technical Specifications, Drawings and other sections of the Bidding Documents to ascertain the full scope

of work included in each item while filling in the rates and prices. We agree that the entered rates and prices shall be deemed to include the full scope as aforesaid, including overheads and profit.

- 3.1 We understand that in the price schedules, where there are discrepancy between the unit price and the total price, which is obtained by multiplying the unit price and quantity, or between subtotals and the total price, (even in case of carry forward of prices) the unit or subtotal price shall prevail and the total price shall be corrected accordingly. We further understand that where there is a discrepancy between amounts stated in figures and amounts stated in words, the amount stated in words shall prevail. Similarly, in case of any discrepancies between the total bid price and the summation of Schedule prices (price indicated in a Schedule indicating the total of that Schedule), the total bid price shall be corrected to reflect the actual summation of the Schedule prices.
- 3.2 We declare that prices left blank in the Schedules will be deemed to have been included in the prices of other items. The TOTAL price indicated in the BOQ shall be deemed to be the total price for executing the Facilities in complete accordance with the Contract, whether or not each individual item has been priced.
- 4.0 We hereby confirm that the rates/prices quoted by us in Schedule-9 (Schedule of Take Out Prices) and Schedule-10 (Schedule of Unit Rates) are consistent with the lumpsum bid price and that we shall furnish all necessary justification to establish the reasonableness of these rates/prices, if required by you. However, we clearly understand that the acceptance of our proposal for the subject package shall not mean automatic acceptance of these rates/prices and that these rates/prices shall be adopted only if their reasonableness has been established by us and accepted by you.
- 5.0 Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are specified in Attachment-4(P).
- 6.0 Until a formal Contract is prepared and executed between us, this bid, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.
- 7.0 We understand that you are not bound to accept the lowest or any other bid you may receive.
- 8.0 We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal, is in all respects for and in good faith, without collusion or fraud.

Dated this.....day of. 20.....

Thanking you, we remain,

Yours faithfully,

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common Seal).....

ATTACHMENT – 1P

(Declaration regarding Import Content included in our Price bid)

1. We confirm the details of Import Content included in our bid in respect of Ex-works (India) price quoted in Schedule-2 are as follows:
2. These details are furnished for the purpose of issuance of Essentiality Certificate / Letter of Recommendation by the employer as per Clause 10.6 Section-II, ITB.

Sl. No.	Description of item to be supplied	Quantity	Value in INR (included in our bid price)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
	Total		

Note: Bidder may apprise themselves of provisions of bidding documents regarding “Preference to Make in India and Eligibility for Participation/ granting of Purchase Preference to Class-I local suppliers” before submission of bid

*Please state the currency and fill in the amount in figures and words.

Date : (Designation).....

Place: (Printed Name).....

Note: (i) Continuation sheets of like size and format may be used as per Bidders requirements and shall be annexed to this Attachment.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. NVVN/C&M/RE-333/2024-25

(Declaration regarding Customs Duty Benefits for import of Construction Equipment)

Dear Sir,

1. We confirm that we have read and understood Clause No. 10.6 of ITB, Sec-II of Bidding Document and we are submitting our bid including price schedules accordingly
2. We confirm that we are solely responsible for obtaining Customs Duty benefits for import of Construction Equipment which we have considered in our bid and in case of failure to receive such benefits, Employer will not compensate us in any manner whatsoever.
3. We further confirm that we will not claim for adjustment in Contract Price on account of variation in or withdrawal of Customs Duty benefits for import of Construction Equipment.
4. We are furnishing below the information required by the Employer for issue of relevant Certificates in terms of the Customs Acts & Notifications of Govt. of India:

(A) *CIF Value of Construction Equipment to be imported by the Bidder / Assignee (if applicable in case of foreign bidder) including its sub-contractor(s) of the Bidder/Assignee.

We further confirm that aforesaid CIF value has not been included in Attachment-1P.

* Please state the currency and fill in the amount in figures and words.

(B). Description and quantities of the Construction Equipment to be imported by the Bidder / Assignee (if applicable) / sub-contractor(s) for deployment to site under the package.

Sl.No.	To be imported by	Description of Item to be imported	Quantity
(i)	Bidder		
(ii)	Assignee (if applicable)		
(iii)	Sub-Contractor(s)		

4.0 We confirm that the Construction Equipment being imported as per 'B' above shall be deployed at the Project Site for the purpose of execution of Subject Package

Date : (Designation).....

Place: (Printed Name).....

Note: (i) Continuation sheets of like size and format may be used as per Bidders requirements and shall be annexed to this Attachment.

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. : NVVN / C&M / RE-333 / 2024-25

(Details of Equipment and Mandatory Spares to be imported from Associate/Collaborator by manufacturer or bidder)

Bidder's Name and Address :

To
NTPC Limited, (CS)
5th Floor, Engineering Office
Complex, Plot A-8A, Sector 24,
Noida-201301, Distt. Gautam Budh
Nagar, State of U.P., India

Dear Sirs,

We confirm that we are seeking qualification on the basis of association/collaboration with the manufacturer(s) of particular equipment(s). We further confirm that such equipment and mandatory spares, which shall be imported from the associate's/collaborator's country by the manufacturer or by us have been listed in this Attachment-2(P) and the price of such equipment and mandatory spares including type test(s) have been quoted on CIF (Indian port-of-entry) basis and included in the total CIF (Indian port-of-entry) price quoted by us in Schedule-1.

Sl.No.	Description of Equipment/ Mandatory Spare/Type Test	Quantity/Weight	Value in bid currency*
--------	--	-----------------	---------------------------

* Total

Date :

(Signature).....

Place :

(Printed Name).....

(Designation).....

(Common Seal)

- Note :
1. This Attachment is to be filled in by all bidders.
 2. *Bidder shall state the currency and fill in the amount in words and figures.
 3. Continuation sheets of like size and format may be used as per Bidder's requirement and shall be annexed to this Attachment.
 4. Bidder may refer ITB Cl. 10.4 (a) also.

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT
BIDDING DOCUMENT NO. NVVN / C&M / RE-333/2024-25
(Declaration on Demonstration Parameter)**

<p>1. Net Heat Rate</p> <p>(i) Net Heat Rate at 100% of Engine load</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	
<p>2. NET Power Output at Base/Full Load</p> <p>(i) Net Power Output of each Genset in kW. (ii) No. of Identical Engines offered (iii) Total Net Power Output for the Power Plant</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	To be filled here
<p>3. NO_x Emission Level</p> <p>(i) We Confirm NO_x emission level of less than 80 ppm (dry volume basis corresponding to 15% excess oxygen in Engine exhaust) while operating at 100%, 90%,80%,70%,60% & 50% of Base Load Output</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	<u>Yes/No</u>
<p>4. Noise</p> <p>We Confirm The noise levels shall meet the MoEF&CC guidelines as enclosed at Annexure-I of Volume-IV, Part-A, Section-VI.</p> <p>(as specified in chapter of PART-A Volume-V Guarantees, Performance Testing & Liquidated Damage of Section-VI of Bidding Documents)</p>	<u>Yes/No</u>
<p>5. Plant Effluent Quality and Quantity.</p> <p>We Confirm All liquid effluents emanating out of the power plant shall be treated (as required) to meet the Environmental Standards for Gas Naphtha-based Thermal Power Plants published by MOEF vide notification dated 22.12.1998 and General Standard for Discharge of Environment Pollutants, Part-A: Effluents Published by MOEF dated 19.05.93 & also the latest MoEF&CC notification for discharge standards for effluents dated 13.10.2017 under E(P) Rules & its amendment thereof, applicable for discharge in Inland Surface Waters, whichever are more stringent.</p>	<u>Yes/No</u>

<p>The discharge standards to be followed are enclosed at Annexure–II (A) & Annexure–II (B) of Volume-IV Part-A, Section-VI.</p> <p>The treated effluents shall also meet quality requirements of CPCB, if more stringent than the standard mentioned in technical specifications.</p> <p>As per clause 6.03.02 of Volume-IV, Part-A, Section-VI Devices for measurement of pH, Turbidity, Conductivity, and Flow at the point of liquid effluent discharge out of the plant shall be installed.</p> <p>We confirm to meet effluent quality & quantity parameters as specified in Chapter-M3 of Volume-I, Part-B, Section-VI.</p>	
<p>6. Plant Auxiliaries</p> <p>Demonstration parameters as per Clause 1.04.03 of Section-VI, Part-A, Volume-V, Guarantee Requirements</p>	<p><u>Confirm/Not Confirm</u></p>

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. : NVVN / C&M / RE-333 / 2024-25

(Details in respect of Local Agent)

Bidder's Name and Address :

To
NTPC Limited, (CS)
5th Floor, Engineering Office Complex, Plot A-8A,
Sector 24, Noida-201301, Distt. Gautam Budh Nagar,
State of U.P., India

Dear Sir,

We furnish below the following information in respect of our Local Agent: (i) Name and address of the Local Agent

.....
.....
.....

(ii) Services to be rendered by the Local Agent

.....
.....
.....

(iii) Amount.....

.....

Date : (Signature).....

Place : (Printed Name).....

(Designation).....

(Common Seal)

**ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)
BIDDING DOCUMENT NO. : NVVN / C&M / RE-333 / 2024-25
(Price Adjustment Data)**

Bidder's Name and Address:

To
Contract Services
NTPC Limited,
Noida - 201301

Dear Sirs,

We hereby furnish the relevant details pertaining to the price adjustment provisions in your bidding documents.

1A. Ex-Works / FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Steam Generator Systems excl. Factory Fabricated Structures, Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)

BIDDERS ARE REQUIRED TO INDICATE SEPARATE INDICES FOR EACH CURRENCY.

*Name of Currency of Bid Price ::

Sl. No.	Item	Value of Co-efficient	Name of Published Index and its origin	Value of Indices (as on 30 days prior to date set for Submission of Techno-Commercial Bids).
Material				
1.	.....#.....	a =	.....	.....
2.	.....#.....	b =	.....	.....
3.	.....#.....	c =	.....	.....

		Labour	Lb =	.....
		Fixed Component	F = 0.15	

Sum of all material co-efficients, i.e. a+b+c+..... etc. indicated above shall be between 0.50 to 0.60.

To be specified by Bidder.

@Use separate sheets for FOB / Ex-Works price.

The labour co-efficient shall be between 0.25 to 0.35.

Sum of all material co-efficients and labour coefficient shall be 0.85.

Sum of all material co-efficients, labour coefficient and fixed component should be 1.0

1B. Ex-Works / FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Steam Turbine Generator Systems excl. Factory Fabricated Structures, Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)

BIDDERS ARE REQUIRED TO INDICATE SEPARATE INDICES FOR EACH CURRENCY.

*Name of Currency of Bid Price ::

Sl. No.	Item	Value of Co-efficient	Name of Published Index and its origin	Value of Indices (as on 30 days prior to date set for Submission of Techno-Commercial Bids).
Material				
1.	.....#.....	a =	.....	.....
2.	.....#.....	b =	.....	.....
3.	.....#.....	c =	.....	.....

		Labour	Lb =	.....
		Fixed Component	F = 0.15	

Sum of all material co-efficients, i.e. a+b+c+..... etc. indicated above shall be between 0.50 to 0.60.

To be specified by Bidder.

@Use separate sheets for FOB / Ex-Works price.

The labour co-efficient shall be between 0.25 to 0.35.

Sum of all material co-efficients and labour coefficient shall be 0.85.

Sum of all material co-efficients, labour coefficient and fixed component should be 1.0

1C. Ex-Works / FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Balance of Plant Systems excl. Factory Fabricated Structures, Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)

BIDDERS ARE REQUIRED TO INDICATE SEPARATE INDICES FOR EACH CURRENCY.

*Name of Currency of Bid Price ::

Sl. No.	Item	Value of Co-efficient	Name of Published Index and its origin	Value of Indices (as on 30 days prior to date set for Submission of Techno-Commercial Bids).
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Material

1.#.....	a =
2.#.....	b =
3.#.....	c =

Labour

Lb =

Fixed Component

F = 0.15

Sum of all material co-efficients, i.e. a+b+c+..... etc. indicated above shall be between 0.50 to 0.60.

To be specified by Bidder.

@Use separate sheets for FOB / Ex-Works price.

The labour co-efficient shall be between 0.25 to 0.35.

Sum of all material co-efficients and labour coefficient shall be 0.85.

Sum of all material co-efficients, labour coefficient and fixed component should be 1.0

1D. Ex-Works / FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)

BIDDERS ARE REQUIRED TO INDICATE SEPARATE INDICES FOR EACH CURRENCY.

*Name of Currency of Bid Price ::

Sl. No.	Item	Value of Co-efficient	Name of Published Index and its origin	Value of Indices (as on 30 days prior to date set for Submission of Techno-Commercial Bids).
---------	------	-----------------------	--	--

Material

1.#.....	a =
----	-------------	-----	-------	-------

2.#..... b =
 3.#..... c =

Labour Lb =
Fixed Component F = 0.15

Sum of all material co-efficients, i.e. a+b+c+..... etc. indicated above shall be between 0.50 to 0.60.

To be specified by Bidder.

@Use separate sheets for FOB / Ex-Works price.

The labour co-efficient shall be between 0.25 to 0.35.

Sum of all material co-efficients and labour coefficient shall be 0.85.

Sum of all material co-efficients, labour coefficient and fixed component should be 1.0

1E. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Factory Fabricated Structures as specified in Technical Specification and in coherence to Price Schedule)

BIDDERS ARE REQUIRED TO INDICATE SEPARATE INDICES FOR EACH CURRENCY.

*Name of Currency of Bid Price ::

Sl. No.	Item	Value of Co-efficient	Name of Published Index and its origin ^{\$}	Value of Indices (as on 30 days prior to date set for Submission of Techno-Commercial Bids).
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Material

1	Hot Rolled Coils & Sheets.	a =0.45	Index for "Hot Rolled (HR) Coils & Sheets, including Narrow Strip" under sub-group of "Mild Steel -Flat Products" under Group of "Manufacture of Basic Metals" as published by Ministry of Commerce and Industry, GOI
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2.	Manufacture of fabricated metal products- Structural metal product	b=0.15	Index for "Manufacture of structural metal products" under Group of "Manufacture of Fabricated metal products, except Machinery and Equipment" as published by Ministry of Commerce and Industry, GOI
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Labour		Lb =0.25	Consumer price index for industrial workers (All India General) as published by Labour Bureau, Shimla.
---------------	--	----------	--	-------

Fixed Component F = 0.15

Specified source of indices is for Ex-Works Price Component only. Bidder to furnish the same for FOB Price Component.

1F. Ex-Works /FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Any other Items not covered in A to E above and in coherence to Price Schedule)

BIDDERS ARE REQUIRED TO INDICATE SEPARATE INDICES FOR EACH CURRENCY.

*Name of Currency of Bid Price ::

Sl. No.	Item	Value of Co-efficient	Name of Published Index and its origin	Value of Indices (as on 30 days prior to date set for Submission of Techno-Commercial Bids).
Material				
1.	.....#.....	a =	.....	.....
2.	.....#.....	b =	.....	.....
3.	.....#.....	c =	.....	.....

	Labour	Lb =		.....
	Fixed Component	F = 0.15		

Sum of all material co-efficients, i.e. a+b+c+..... etc. indicated above shall be between 0.50 to 0.60.

To be specified by Bidder.

@Use separate sheets for FOB / Ex-Works price.

The labour co-efficient shall be between 0.25 to 0.35.

Sum of all material co-efficients and labour coefficient shall be 0.85.

Sum of all material co-efficients, labour coefficient and fixed component should be 1.0

2. ERECTION PRICE COMPONENT (A)

INDIAN FIELD LABOUR :

The indices used for Indian Field Labour are (i) All India Consumer Price Index for Industrial

Workers (All India Monthly Average) published by Labour Bureau, Simla, Government of India and (ii) Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher.

i. The value of the All India Consumer Price Index for Industrial Workers (All India Monthly Average) published by Labour Bureau, as on 30 days prior to the deadline set for Submission of the bids is.....

ii. The value of the Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher, as on 30 days prior to the deadline set for Submission of the bids is.....

(A) **EXPATRIATE LABOUR :

* Name of currency of Bid Price :

The name of published index and its origin used for expatriate Labour (EF) is.....

3. Structural Work Price Component

Sl. No.	Item	Value of Co-efficient	Name of Published index and its origin	Value of Indices (as on 7 days prior to deadline set for Submission of bids)
1.	Fixed Components	F = 0.20		.....
2.	Hot Rolled Coils & Sheets	a = 0.50	Index for "Hot Rolled (HR) Coils & Sheets, including Narrow Strip" under sub-group of "Mild Steel -Flat Products" under Group of "Manufacture of Basic Metals" as published by Ministry of Commerce and Industry, GOI	.....
3.	Manufacture of fabricated Metal Products-Structural Metal Product	b = 0.15	Index for "Manufacture of structural metal products" under Group of "Manufacture of Fabricated metal products, except Machinery and Equipment" as published by Ministry of Commerce and Industry, GOI	.....
4.	Labour			

- (i) $0.5 \times L_b = 0.5 \times 0.15$ Consumer price index for industrial workers (All India General) as published by Labour Bureau, Shimla.
- (ii) $0.5 \times L_b = 0.5 \times 0.15$ Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher

4. Civil Works Price Component :

Item	Index	Value of Coefficients	Name of published index and its	Value of Indices (as on 7 days prior to deadline set for submission of bids)
1. Fixed Components F = 0.20				
2. Labour				
	(i)	$0.5 \times L_b = 0.5 \times 0.25$	Consumer price index for industrial workers (All India General) as published by Labour Bureau, Shimla.	
	(ii)	$0.5 \times L_b = 0.5 \times 0.25$	Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher	
3.	Material (excluding cement & steel)	$m = 0.15$	Index no. of wholesale Price under group "All Commodities" as published by Ministry of Commerce and Industry, GOI	.....
4.	High Speed Diesel	$d = 0.05$	Price of high speed diesel oil per litre at the Indian Oil Corpn. outlet nearest to the project (selling price inclusive of taxes & duties, if any)	.....

5.	Steel	s = 0.25	Index for ***"Mild Steel -Long Products" / ***"Mild Steel- Flat Products" under Group of Products as published by Ministry of Commerce and Industry, GOI.	.....
6.	Cement	c = 0.10	Index for "Pozzolana Cement" as published by Ministry of Commerce and Industry, GOI.	.....

5. We agree to provide you with a complete break-up of our Bid Price to enable operation of Price adjustment Clause for aforesaid all price components.

* Continuation sheets of like size & format shall be used, if required, in case number of currencies are more.

** Continuation sheets of like size and format may be used if countries of origin of expatriate labour are more.

*** **Bidder to strike-off , whichever is not applicable.**

Date : (Signature).....
Place : (Printed Name).....
(Designation).....
(Common Seal)

Note : Bidder shall note that it is mandatory to furnish the values of various coefficients and name, source & origin of the published indices and its base values in this Attachment-5(P) to Bid. Bidder is also required to mention whether the indices are monthly average, weekly average or as applicable

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

BIDDING DOCUMENT NO. : NVVN / C&M / RE-333 / 2024-25

CHECK LIST OF DOCUMENTS FOR ENVELOPE-II:

PRICEBID

<i>Sl. No.</i>	<i>Details of Checks</i>	<i>Enclosed: Yes/No.</i>
1.	Bid Form (Price Bid)	
2.	Attachment 1P	
3.	Attachment-1A (P)	
4.	Attachment 2P	
5.	Attachment-4P	
6.	Attachment -5P	
7.	Attachment- 16A	
8.	All Price Schedules and BOQ	

Date: (Designation).....

Place: (Printed Name).....

PRICE SCHEDULE & SUMMARY

**(Uploaded online in Excel File in the same format
as downloaded with bidding document)**



SECTION – VII (Part 3 OF 3)

FORMS AND PROCEDURES

FOR

ANDAMAN & NICOBAR GAS ENGINE POWER PROJECT (50 MW)

IFB DOCUMENT NO.: NVVN/C&M/RE-333/2024-25

(This document is meant for the exclusive purpose of bidding against this Bid Document No. / Specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

TABLE OF FORMS AND PROCEDURES

Sl.No.	Description
Section-VII (Part 1 of 3)	
1a.	Techno-Commercial Bid (Envelope-1) (Bid Form along with Attachments)
Section-VII (Part 2 of 3)	
1b.	Price Bid (Envelope-2) (Bid Form along with attachments and Price Schedules)
Section-VII (Part 3 of 3)	
2.	Bid Security Form – Bank Guarantee
2a.	Bid Security Form – Insurance Surety Bond
2b.	Bid Security Form – Letter of Credit NOT APPLICABLE
2c.	Letter of Undertaking
3	(a) Form of Notification by the Employer to the Bidder (b) Form of Sight Draft
4.	Forms of Notification of Award
5.	<u>Form of Contract Agreement</u>
6.	Performance Security Form
6a.	Performance Security Form incase of Contract awarded to Joint Venture - NOT APPLICABLE
6b.	Performance Security Form for O&M
7(i).	Bank Guarantee Form for Advance Payment (Supply Ex-Works)

- 7(ii). Bank Guarantee Form for Advance Payment
(Installation Services)
- 7(iii). Bank Guarantee Form for Advance Payment- **NOT APPLICABLE**
(in case of Contract awarded to Joint Venture)
8. Form of Completion Certificate
9. Form of Operational Acceptance Certificate
10. Form of Trust Receipt
11. Forms of Indemnity-cum-Undertaking Agreement (2Nos.)
12. Form of Authorization Letter
13. Form of Deed of Joint Undertaking (**NOT APPLICABLE**)
14. Form of Bank Guarantee by
Associate/ Collaborator
15. Form of Joint Venture Agreement - **NOT APPLICABLE**
16. Form of Bank Guarantee Verification Checklist
17. Form of Extension of Bank Guarantee/Insurance Surety Bond
18. Form of Contract Closing Certificate
19. Form of Certificate regarding Bank Guarantee charges
20. Form of Indemnity-cum-Undertaking Agreement (For Removal/Disposal of
Scrap/Surplus Material)

2. BID SECURITYFORM

2. Bid Security Form

To
[Employer's Name and Address]

Dear Sirs,

In accordance with Invitation for Bids under your Bid Document No. **NVVN / C&M / RE-333 / 2024-25** M/s..... having its Registered/Head Office at (hereafter called the 'Bidder') wish to participate in the said bid for EPC PACKAGE FOR PROJECT

As an irrevocable Bank Guarantee against Bid Security for an amount of (*) valid for 225 days from (**) is required to be submitted by the Bidder as a condition precedent for participation in the said bid which amount is liable to be forfeited on the happening of any contingencies mentioned in the Bidding Documents.

We, the [Name & address of the Bank] having our Head Office at..... (#)..... guarantee and undertake to pay immediately on demand by NTPC Vidyut Vyapar Nigam Limited (hereafter called the 'Employer') the amount of (*)..... without any reservation, protest, demand, demur and recourse. Any such demand made by the 'Employer' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder.

This Guarantee shall be irrevocable and shall remain valid up to (@)..... If any further extension of this Guarantee is required, the same shall be extended to such required period (not exceeding one year) on receiving instructions from M/s [Bidder's Name]..... on whose behalf this Guarantee is issued.

In witness whereof the Bank, through its authorised officer, has set its hand and stamp on this..... day of..... 20..... at.....

.....
(Signature)

.....
(Name)

.....
(Designation with
Bank Stamp)

Authorised Vide
Power of Attorney No.....
Date.....

NOTE : 1. (*) The amount shall be as specified in the Bid Data Sheets.

(**) This shall be the date of opening of Techno-commercial bids.

(#) Complete mailing address of the Head Office of the Bank to be given.

(@) This date shall be forty five (45) days after the last date for which the bid is

valid.

2. The Bank Guarantee shall be from a Bank as per provisions of ITB Sub-Clause 12.2 of the Bidding Documents.
3. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG is executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Bidder/Bank issuing the guarantee.
4. While getting the Bank Guarantee issued, Bidders are required to ensure compliance to the points mentioned in Form 15-Form of Bank Guarantee Verification Check List enclosed in Section-VII of Bidding Documents. Further, Bidders are required to fill up this Form 15 and enclose the same with the Bank Guarantee.
5. In case, Bank Guarantee is getting issued from State Bank of India, Bidder to take note of NTPC letter ref. NTPC/FC/CS/BG/01 dated 03.09.2014 and SBI letter ref. CAG-I/AMT-1/2014-15/370 dated 04.09.2014 (attached with Section-III of Bidding Documents).

2a. Form of Insurance Surety Bond towards Bid Security

(To be stamped in accordance with Stamp Act of India)

Insurance Surety Bond No.

Date.....

To

NTPC Limited, (CS)
6th Floor, Engineering Office Complex, Plot
A-8A, Sector 24, Noida-201301,
Distt. Gautam Budh Nagar, State of U.P., India
Dear Sirs,

In accordance with Invitation for Bids under your Bid Document No. **NVVN / C&M / RE-333 / 2024-25**, M/s..... having its Registered/Head Office at (hereafter called the 'Bidder') wish to participate in the said bid for EPC PACKAGE FOR PROJECT

As an irrevocable Insurance Surety Bond against Bid Security for an amount of.....(*).....valid for 225 days from(**)..... required to be submitted by the Bidder as a condition precedent for participation in the said bid which amount is liable to be forfeited on the happening of any contingencies as mentioned under the Bidding Documents.

We, the [Name & address of the Insurer]having our Head Office at (#) guarantee and undertake to pay immediately on demand by NTPC VIDYUT VYAPAR NIGAM Limited (hereafter called the 'Employer') the amount of(*)..... without any reservation, protest, demand and recourse. Any such demand made by the 'Employer' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder and/or any right/remedy available to the bidder in terms thereof.

This Insurance Surety Bond shall be unconditional as well as irrevocable and shall remain valid upto(@)..... If any further extension of this Insurance Surety Bond is required, the same shall be extended to such required period (not exceeding one year) on receiving instructions from M/s [Bidder's Name]..... on whose behalf this Insurance Surety Bond is issued.

In witness where of the Insurer, through its authorised officer, has set its hand and stamp on this.....day of.....20.....at.....

.....
(Signature)

.....
(Name)

.....
(Designation with
Insurer Stamp)

Authorised Vide
Power of Attorney No.....

Date.....

- NOTE :
1. (*) The amount shall be as specified in the Bid Data Sheets.
(**) This shall be the date of opening of Techno-commercial bids.
(#) Complete mailing address of the Head Office of the Insurer to be given.
(@) This date shall be forty five (45) days after the last date for which the bid is valid.
 2. The Insurance Surety Bond shall be from an Insurer as per guidelines issued by Insurance Regulatory and Development Authority of India (IRDAI) as amended from time to time.
 3. The Employer shall be the Creditor, the Bidder shall be the Principal debtor and the Insurance company/Insurer shall be the Surety in respect of the Insurance Surety Bond to be issued by the Insurer.
 4. The Insurance Surety Bond should be on Non-Judicial stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the state(s) where the Insurance Surety Bond is submitted or is to be acted upon or the rate prevailing in State where the Insurance Surety Bond is executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Bidder/Insurer issuing the Insurance Surety Bond.
 5. While getting the Insurance Surety Bond issued, Bidders are required to ensure compliance to the points mentioned in Form of Bank Guarantee/Insurance Surety Bond Verification Check List enclosed in this Section of Bidding Documents. Further, Bidders are required to fill up this Form and enclose the same with the Insurance Surety Bond.

**3. (a) FORM OF NOTIFICATION BY THE
EMPLOYER TO BIDDER**

(b) FORM OF SIGHTDRAFT

3a. FORM OF NOTIFICATION BY THE EMPLOYER TO THE BIDDER

M/s.....

Ref : Your proposal against our IFB No.....
Forfeiture of Bid Guarantee amount.

Dear Sirs,

Whereas you have furnished as a part of your proposal the Bid Guarantee in the form of irrevocable and confirmed Letter of Credit No.....dated.....
.....for a sum of.....
(Bank's name)
.....payable to..... (Name of the Employer) on demand without any reservation, demur or protest, contest and recourse at.....
...
(Name and place of Bank)

In terms of the aforesaid Bid Guarantee, we do hereby forfeit the Guarantee amount.

For..... (Name of the Employer)

(AUTHORISED SIGNATORY)

N.B. The Letter of Credit should not stipulate any other proforma of notification different from this format. No change whatsoever in the said proforma is acceptable to the Employer.

3b. FORM OF SIGHT DRAFT

Drawn under L.C. No.....dated.....

of

.....
(Name of Bank that opened the L.C.)

At sight promptly pay to.....

(Name of the Bank at which L/C, is negotiable

.....or order sum of.....

for payment to the Employer)

(Amount of L/C)

for value received.

For..... (Name of the Employer)

(AUTHORISED SIGNATORY)

To,

(Name and Address of the
Bank which opened L.C.)

4. FORM OF NOTIFICATION OF AWARD

**4a. FORM OF 'NOTIFICATION OF AWARD OF CONTRACT'
FOR SUPPLY OF PLANT AND EQUIPMENT**

NOTE: INSTRUCTIONS INDICATED IN ITALICS IN THIS NOTIFICATION OF AWARD ARE TO BE TAKEN CARE OF BY THE ISSUING AUTHORITY.

Ref. No. :

Date:

..... (Contractor's Name & Address).....
.....
.....
.....

Attn.: Mr.....

Sub: Notification of Award of Contract for Supply of.....(Package Name) as per Bidding Document No.....

Dear Sir,

1.0 This has reference to the following:

- (i) Our Notice Inviting Tender (IFB) No.....dated
- (ii) Bidding Documents for the subject package issued to you vide our letter no.datedcomprising the following:

.....(List out all the Sections/Volumes of the Bidding Documents along with Tender Drawings etc. as issued to the bidder).....

Errata/Amendment No..... to..... (***Name of Section/Volume of the Bidding Documents to which Errata/Amendment pertains***).....
Issued to you vide our letter no. Dated.....

(Applicable only if any Errata/Amendment to the Bidding Documents has been issued subsequently)

- (iii) Clarifications furnished to you on the Bidding Documents vide our letter no.....dated.....based on the query raised by **you/one of the prospective bidders. (Use as applicable)**

**(Applicable only if any clarification to the Bidding Documents has been issued subsequently)
(INCLUDE AS FURTHER SUB-PARAGRAPHS ANY OTHER CORRESPONDENCE MADE TO THE BIDDER AFTER ISSUANCE OF BIDDING DOCUMENTS UP TO THE DATE OF BID OPENING)**

(iv) Your Proposal for the subject package submitted vide your letter No. dated..... **and its modification vide letter no.dated.....(Delete if not applicable).**

(v) Our Fax message / letter No. dated..... regarding extension of validity of bid and that of the Bank Guarantee towards Bid Security.

(Applicable only if any extension has been sought subsequently)

(INCLUDE AS FURTHER SUB-PARAGRAPHS ANY OTHER CORRESPONDENCE MADE TO OR BY THE BIDDER AFTER BIDOPENING)

(vi) Our Fax message/letter No. dated..... inviting you for post bid discussions.

(vii) Post bid discussions and meetings we had with you fromto resulting into the following Minutes of Meeting enclosed herein with this Notification of Award :

(a) Minutes of Meeting regarding Commercial issues(APPENDIX)

(b) Minutes of Meeting on Technical issues(APPENDIX)

(c) Minutes of Meeting regarding Work Schedule(APPENDIX)

(d) Minutes of Meeting regarding Quality Assurance Aspects (APPENDIX-.)

(e) Minutes of Meeting regarding Safety Plan(APPENDIX-)

2.0 We confirm having accepted your proposal submitted vide letter no..... Dated **and its modification vide letter no..... dated (Delete if not applicable)** read in conjunction with all the specifications, terms & conditions of the Bidding Documents, **Your subsequent letters (Use if relevant)** and agreed Minutes of Meetings referred to in para 1.0 above and award on you the Contract for the work of **(Indicate brief Scope of Work)**.....of **(Name of Package)**for **(Name of Project)**..... as per Specification No.:..... (Hereinafter referred to as the 'First Contract').

3.0 We have also notified you vide our Notification of Award No. Dated and Notification of Award No.....dated for award of Second Contract and Third Contract respectively on you for the work of **(Indicate brief scope of work of the Second Contract and Third Contract)** complete **(Name of Package)**.....for..... **(Name of Project)**.....as per Bidding Document No..... (Hereinafter referred to as the 'Second Contract' and 'Third Contract'). You shall also be fully responsible for the works to be executed under the 'Second Contract' and 'Third Contract' and it is expressly understood and agreed by you that any breach under the 'Second Contract' and/or 'Third Contract' shall automatically be deemed as a breach of this 'First Contract' and vice-versa and any such breach or occurrence or default giving us a right to terminate the 'Second Contract' and 'Third Contract' and/or recover damages thereunder, shall

give us an absolute right to terminate this Contract and/or recover damages under this 'First Contract' as well and vice-versa. However, such breach or default or occurrence in the 'Second Contract' and/or 'Third Contract' shall not automatically relieve you of any of your responsibilities/obligations under this 'First Contract'. It is also expressly understood and agreed by you that the equipment's /materials to be supplied by you under this Contract when installed and commissioned under the 'Third Contract' shall give satisfactory performance in accordance with the provisions of the Contract.

4.0 The Total Contract Price for the entire scope of work under the Contract shall be **(Specify the amount and currency)**..... as per the following break up:

(i) **Ex-Manufacturing Works/Place**

of Dispatch Price (both in India)
 for Main Equipment

(ii) **Ex-Manufacturing Works/Place**

of Dispatch Price (both in India)
 for Mandatory Spares

(iii) Type Test Charges
 (Delete if not applicable)

TOTAL (i + ii+iii)

(..... **(Specify the total amount in words)**.....)

5.0 You shall prepare and finalize the Contract Documents for signing of the formal Contract Agreement and shall enter into the Contract Agreement with us, as per the proforma enclosed with the Bidding Documents, on non-judicial stamp paper of appropriate value within.....**(Specify)**days from the date of this Notification of Award.

6.0 This Notification of Award is being issued to you in duplicate. We request you to return its duplicate copy duly signed and stamped on each page including all the enclosed Appendices, by the authorized signatory of your company as a proof of your acknowledgement and confirmation.

Please take necessary action to commence the work and confirm action.

Yours faithfully,
 for and on behalf of
 **(Name of the Employer)**.....
(Authorized Signatory)

Encl.: As above.

**4b. FORM OF 'NOTIFICATION OF AWARD OF CONTRACT' FOR
INSTALLATION OF PLANT AND EQUIPMENT**

NOTE: *INSTRUCTIONS INDICATED IN ITALICS IN THIS NOTIFICATION OF AWARD ARE TO BE
TAKEN CARE OF BY THE ISSUING AUTHORITY.*

Ref. No. :

Date :

.....(**Contractor's Name & Address**).....

.....
.....
.....

Attn : Mr.....

**Sub : Notification of Award of Contract for Inland Transportation, Insurance,
Installation, Testing & Commissioning and Guarantee Tests of ... (Package
Name)**

..... as per Bidding Document No.....

Dear Sir,

1.0 This has reference to the following:

(i) Our Invitation for Bids (IFB) No.....dated.....

(ii) Bidding Documents for the subject package issued to you vide our letter no.
.....datedcomprising the following:

.....(**List out all the Sections/Volumes of the Bidding Documents along with Tender
Drawings etc. as issued to the bidder**).....

Errata/Amendment No.....to.....(**Name of Section/Volume
Of the Bidding Documents to which Errata/Amendment pertains**).....
issued to you vide our letter no.dated.....

**(Applicable only if any Errata/Amendment to the Bidding Documents has been issued
subsequently)**

(iii) Clarifications furnished to you on the Bidding Documents vide our letter
no.....datedbased on the query raised by **you/one
of the prospective bidders. (Use as applicable)**

(Applicable only if any clarification to the Bidding Documents has been issued subsequently)

**(INCLUDE AS FURTHER SUB-PARAGRAPHS ANY OTHER APPLICABLE
CORRESPONDENCE MADE TO THE BIDDER AFTER ISSUANCE OF
BIDDING DOCUMENTS UP TO THE DATE OF BID OPENING)**

(iv) Your Proposal for the subject package submitted vide your letter No. Dated **and its modification vide letter no.dated..... (Delete if not applicable).**

(v) Our Fax message/letter No. Dated..... regarding extension of validity of bid and that of the Bank Guarantee towards Bid Security.
(Applicable only if any extension has been sought subsequently)

(INCLUDE AS FURTHER SUB-PARAGRAPHS ANY OTHER APPLICABLE CORRESPONDENCE MADE TO OR BY THE BIDDER AFTER BID OPENING)

(vi) Our Fax message/letter No. Dated..... Inviting you for post bid discussions.

(vii) Postbiddiscussionsandmeetingswehadwithyoufrom..... to resulting into the following Minutes of Meetings enclosed herein with this Notification of Award :

- (a) Minutes of Meetings regarding Commercial issues(APPENDIX.....)
- (b) Minutes of Meetings on Technical issues(APPENDIX
- (c) Minutes of Meetings regarding Work Schedule(APPENDIX.....)
- (d) Minutes of Meetings regarding Quality Assurance Aspects(APPENDIX-.)
- (e) Minutes of Meeting regarding Safety Plan(APPENDIX-)**

2.0 We confirm having accepted your proposal submitted vide letter no..... dated..... **and its modification vide letter no dated (Delete if not applicable)** read in conjunction with all the specifications, terms & conditions of the Bidding Documents, **Your subsequent letters (Use if relevant)** and agreed Minutes of Meetings referred to in para 1.0 above and award on you the Contract for the work of**(Indicate brief Scope of Work)** of **(Name of Package)** for **(Name of project)** as per Specification No. : (Hereinafter referred to as the 'Third Contract').

3.0 We have also notified you vide our Notification of Award No. Dated..... and Notification of Award No.....dated for award of 'FirstContract'and'SecondContract'respectivelyonyoufortheworkof..... **(Indicate brief scope of work of the First Contract and Second Contract)** complete..... **(Name of Package)**..... for **(Name of Project)** as per Bidding Document No..... (Hereinafter referred to as the 'First Contract' and 'Second Contract'). You shall also be fully responsible for the works to be executed under the 'First Contract' and 'Second Contract' and it is expressly understood and agreed by you that any breach under the 'First Contract' and/or 'Second Contract' shall automatically be deemed as a breach of this 'Third Contract' and vice-versa and any such breach or occurrence or default giving us a right to terminate the 'First Contract' and/or 'Second Contract' and/or recover damages thereunder, shall give us an absolute right to terminate this Contract and/or recover damages under this 'Third Contract' as well and vice-versa. However, such breach or default or occurrence in the 'First

Contract' and/or 'Second Contract' shall not automatically relieve you of any of your responsibilities/obligations under this 'Third Contract'. It is also expressly understood and agreed by you that the equipment's / materials to be supplied by you under the 'First Contract' and 'Second Contract' when installed and commissioned under this 'Third Contract' shall give satisfactory performance in accordance with the provisions of the Contract.

4.0 The Total Contract Price for the entire scope of work under the Contract shall be **(Specify the amount and currency)**..... as per the following break up :

- (i) Inland Transportation and Inland Transit Insurance Charges
including Port Clearance, Port Handling and Port Charges (Delete if not applicable) for Main Equipment
 - (ii) Inland Transportation and Inland Transit Insurance Charges
including Port Clearance, Port Handling and Port Charges (Delete if not applicable) for Mandatory Spares
 - (iii) Unloading and Handling at Site, Storage, Erection, Civil Structural & Allied Works, Insurance Covers other than Inland Transit Insurance, Testing, Commissioning and conducting Guarantee Tests
- TOTAL (i + ii+iii)
 (..... **(Specify the total amount in words)**.....)

5.0 You shall prepare and finalize the Contract Documents for signing of the formal Contract Agreement and shall enter into the Contract Agreement with us, as per the proforma enclosed with the Bidding Documents, on non-judicial stamp paper of appropriate value within.....**(Specify)** days from the date of this Notification of Award.

6.0 This Notification of Award is being issued to you in duplicate. We request you to return its duplicate copy duly signed and stamped on each page including all the enclosed Appendices, by the authorized signatory of your company as a proof of your acknowledgement and confirmation.

Please take necessary action to commence the work and confirm action.
 Yours faithfully,
 for and on behalf of
 **(Name of the Employer)**.....

(Authorized Signatory)

Encl. : As above.

**4cb. FORM OF 'NOTIFICATION OF AWARD OF CONTRACT'
FOR OPERATION AND MAINTENANCE OF PLANT AND EQUIPMENT**

5. FORM OF CONTRACT AGREEMENT

5. Form of Contract Agreement

THIS CONTRACT AGREEMENT is made the _____ day of _____, 20..

BETWEEN

(1) *[Name of Employer]*, a corporation incorporated under the laws of *[country of Employer]* and having its principal place of business at *[address of Employer]* (hereinafter called “the Employer”), and (2) *[name of Contractor]*, a corporation incorporated under the laws of *[country of Contractor]* and having its principal place of business at *[address of Contractor]* (hereinafter called “the Contractor”)

WHEREAS the Employer desires to engage the Contractor to design, manufacture, test, deliver, install, complete and commission certain Facilities, viz. *[list of facilities]* (“the Facilities”) and the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1. Contract 1.1 Documents

Contract Documents (Reference GCC Clause2)

The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

- (a) This Contract Agreement and the Appendices hereto
- (b) Notification of Award
- (c) Special Conditions of Contract
- (d) General Conditions of Contract
- (e) Technical Specifications and Drawings
- (f) The Bid and Price Schedules submitted by the Contractor
- (g) Procedures (as listed)
- (h) Integrity Pact (IP) signed between the Employer and the Bidder /Contractor

1.2 Order of Precedence (Reference GCC Clause 2)

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

1.3 Definitions (Reference GCC Clause 1)

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions of Contract.

Article 2. Contract Price and Terms of Payment

- 2.1 **Contract Price** (Reference GCC Clause 11)
The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of: *[amount of foreign currency in words]*, *[amount in figures]*, and *[amount of local currency in words]*, *[amount in figures]*, or such other sums as may be determined in accordance with the terms and conditions of the Contract
- 2.2 **Terms of Payment** (Reference GCC Clause12)
The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in Appendix 1 (Terms and Procedures of Payment) hereto.

Article3.Effective Date for Determining Time for Completion

- 3.1 **Effective Date** (Reference GCC Clause1)
The Time of Completion of the Facilities shall be determined from the date of Notification of Award provided all of the Following conditions have been fulfilled within a period of two (2) months from the date of said Notification of Award:
- (a) This Contract Agreement has been duly executed for and on behalf of the Employer and the Contractor;
 - (b) The Contractor has submitted to the Employer the performance security, and the advance payment security;
 - (c) The Employer has paid the Contractor the Advance Payment.
- Each party shall use its best efforts to fulfill the above conditions for which it is responsible as soon as practicable.
- 3.2 If the conditions listed under 3.1 are not fulfilled within two (2) months from the date of Notification of Award because of reasons attributable to the Employer, the Contract would become effective only from the date of fulfillment of all the above mentioned conditions and, the parties shall discuss and agree on an equitable adjustment to the Contract Price and the Time for Completion and/or other relevant conditions of the Contract.
- 3.3 However, if any of the conditions listed under 3.1 above are not fulfilled within two (2) months from the date of Notification of Award because of reasons attributable to the Contractor, the Contract will be effective from the date of Notification of

Award. In this case, Contract price and/or time for completion shall not be adjusted.

Article 4.

It is expressly understood and agreed by and between the Contractor and the Employer that the Employer is entering into this Agreement solely on its own behalf and not on behalf of any other person or entity. In particular it is expressly understood and agreed that the Government of India is not a party to this Agreement and has no liabilities, obligations or rights hereunder. It is expressly understood and agreed that the Employer is an Independent legal entity with power and authority to enter into contracts solely on its own behalf under the applicable laws of India and the general principles of Contract Law. The Contractor expressly agrees, acknowledges and understands that the Employer is not an Agent, Representative or Delegate of the Govt. of India. It is further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the Contract. Accordingly, the Contractor expressly waives, releases and foregoes any and all actions or claims, including cross claims, impleader claims or counter claims against the Government of India arising out of this Contract and covenants not to sue the Government of India as to any manner, claim, cause of action or thing whatsoever arising of or under this Agreement.

Article 5. Appendices

The Appendices listed in the attached list of Appendices shall be deemed to form an integral part of this Contract Agreement.

Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by for and on behalf of the Employer

[Signature] _____

[Title] _____

in the presence of _____

Signed by for and on behalf of the Contractor

[Signature]

[Title]

in the presence of _____

CONTRACT AGREEMENT

Dated the _____ day of _____, 20_____

BETWEEN

[“the Employer”]

and

[“the Contractor”]

APPENDICES

- Appendix1 Terms and Procedures of Payment
- Appendix2 Price Adjustment
- Appendix3 Insurance Requirements
- Appendix4 Time Schedule
- Appendix5 List of Approved Subcontractors
- Appendix6 Scope of Works and Supply by the Employer
- Appendix7 List of Documents for Approval or Review
- Appendix8 Functional Guarantees

TERMS AND PROCEDURES OF PAYMENT

In accordance with the provisions of GCC Clause 12 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Break down given in the Section on Price Schedules. Payments will be made in the currencies quoted by the Bidder unless otherwise agreed between the parties. However, applicable taxes, duties and levies shall be reimbursed/paid in local currency. Application for payment in respect of part deliveries may be made by the Contractor as work proceeds.

TERMS OF PAYMENT

- A. Schedule No.1 : Plant and Equipment's (excluding Mandatory Spares and Type Tests) quoted on CIF (Indian-port-of-entry) basis**
In respect of Plant and Equipment's (excluding mandatory spares) supplied from abroad, the following payments shall be made: -

A1. For FOB Price Component of Plant and Equipment's:

- (I) **Fifteen percent (15%)** of the Total FOB Supply Price Component of Contract Price as Initial Advance payment shall be paid as follows:
- (i) Acceptance of Notification of Award and Signing of the Contract Agreement.
 - (ii) Submission of an unconditional Bank Guarantee covering the advance amount which shall be initially kept valid up to (ninety) 90 days beyond the schedule date of Completion of the Facilities under the Package. However, in case of delay in completion of facilities, the validity of this Bank Guarantee shall be extended by the period of such delay. Proforma of Bank Guarantee is enclosed in Section - VII - Bank Guarantee Form for Advance Payment.
 - (iii) Submission by the Main Contractor of an unconditional Bank Guarantee(s) towards Performance Security(s) in respect of all Contracts (including the Contracts entered into with the Contractor's Assignee, if applicable in case of foreign contractor) and submission by the Assignee (if applicable in case of Foreign Contractor) of an unconditional Bank Guarantee(s) towards Performance Security(s) in respect of all Contracts entered into with the Assignee, all initially valid up to ninety (90) days after the end of Defects Liability Period of all equipments covered under the Contract. The proforma of Bank Guarantee is enclosed in Section- VII-Form of Performance Security.

- (iv) Void
- (v) Submission of a detailed PERT Network based on the Work Schedule stipulated in Appendix - 4 to Form of Contract Agreement and its approval by the Employer.
- (II) **Sixty Percent (60%)** of Total FOB Supply Price Component of the Contract Price for each identified equipment upon dispatch of equipment from manufacturer's works on pro-rata basis on production of invoices and satisfactory evidence of shipment (which shall be original Bill of Lading) including Material Dispatch Clearance Certificate (MDCC) issued by the Employer's Corporate QA & I representative.
- (III) **Fifteen Percent (15%)** of Total FOB Supply Price Component of the Contract Price for each identified equipment on receipt of equipment at site on pro rata basis and physical verification and certification by the Project Manager for the equipment received and stored at site.
- (IV) (a) **Five Percent (5%)** of FOB Supply Price Component of the contract price on Completion of the Facilities including all associated auxiliaries and ancillary works and issue of Completion Certificate by the Project Manager.
- (b) Five Percent (5%) of FOB Supply Price Component of the Contract price on successful Completion of Guarantee Tests and issuance of Operational Acceptance Certificate by the Project Manager.

Notes: The basis for the pro-rata payments at S. No. (II) & (III) above shall be the Billing Break-up (BBU) to be finalized subsequently after award of Contract. The Billing Break Up shall be generally on item rate basis. However, for the items which are generally supplied and billed on weight (tonnage) basis, the Billing Break-Up may be considered on weight (tonnage) basis. In case Installation Price (Excluding Civil/Site Fabricated Structural works price) is less than 15% of the cumulative total of FOB & Ex-works Price of Main Equipment, the amount by which it is lower shall be retained proportionately from the FOB & Ex-works component of Contract Price while releasing payments due on receipt of equipment, and no interest shall be payable on

the retained amount. The aforesaid retained amount shall be paid on pro-rata basis upon completion of installation of the respective equipment and its certification by the Project Manager.

(If price are quoted in foreign currency then SBI Bills Selling exchange rate as on the date set for opening of Price Bids shall be considered for the purpose of computing installation percentage/retention amount).

In case the contractor is a nonresident / foreign company, the release of first progressive payment shall also be subject to submissions of certificate / Ruling determining the applicable rate of Income Tax in terms of Relevant provisions of GCC clause on Taxes & Duties and acceptable of the same by the Engineer-in Charge.

A2. Ocean Freight and Marine Insurance Charges (excluding Mandatory Spares parts) for Plant and Equipment's covered in Sl. No. A1 above:

Hundred Percent (100%) of Ocean Freight and Marine Insurance Charges for plant & equipment's (excluding Mandatory Spares) covered in Schedule-1 shall be paid upon shipment on pro-rata basis to the FOB price of the plant and equipment's shipped. The aggregate of all such pro-rata payments shall not exceed the total amount identified in the Contract. However, where equipment wise Ocean Freight and Marine Insurance Charges have been identified in the Contract, the payment of Ocean Freight and Marine Insurance Charges shall be based on such charges identified in the Contract against shipment of equipment's.

B. *Schedule No.2 : Plant and Equipment's (excluding Mandatory Spares) quoted on Ex-works (India) basis*

In respect of Plant and Equipments (excluding Mandatory Spares) which are manufactured within the Employer's country, the following payment shall be made:

B1. Ex-works Price Component of Plant and Equipment's:

- (I) **Fifteen percent (15%)** of the Total Ex-Works Supply Price Component of Contract Price as Initial Advance payment shall be paid as follows:
 - (i) Acceptance of Notification of Award and Signing of the Contract Agreement.
 - (ii) Submission of an unconditional Bank Guarantee covering the advance amount plus GST as applicable on the advance payment to be paid to the contractor which shall be initially kept valid up to

(ninety) 90 days beyond the schedule date of Completion of the Facilities under the Package. However, in case of delay in completion of facilities, the validity of this Bank Guarantee shall be extended by the period of such delay. Proforma of Bank Guarantee is enclosed in Section - VII - Bank Guarantee Form for Advance Payment.

- (iii) Submission by the Main Contractor of an unconditional Bank Guarantee(s) towards Performance Security(s) in respect of all Contracts (including the Contracts entered into with the Contractor's Assignee, if applicable in case of foreign contractor) and submission by the Assignee (if applicable in case of Foreign Contractor) of an unconditional Bank Guarantee(s) towards Performance Security(s) in respect of all Contracts entered into with the Assignee, all initially valid up to ninety (90) days after the end of Defects Liability Period of all equipment's covered under the Contract. The proforma of Bank Guarantee is enclosed in Section-VII-Form of Performance Security.
 - (iv) VOID
 - (v) Submission of a detailed PERT Network based on the Work Schedule stipulated in Appendix - 4 to Form of Contract Agreement and its approval by the Employer.
- (II) **Sixty Percent (60%)** of Total Ex-Works Supply Price Component of the Contract Price for each identified equipment upon dispatch of equipment from manufacturer's works on pro-rata basis on production of invoices and satisfactory evidence of shipment (which shall be original Goods Receipt or receipted GR/Rail receipt) including Material Dispatch Clearance Certificate (MDCC) issued by the Employer's Corporate QA & I representative.
- (III) **Fifteen Percent (15%)** of Total Ex-Works Supply Price Component of the Contract Price for each identified equipment on receipt of equipment at site on pro rata basis and physical verification and certification by the Project Manager for the equipment received and stored at site.
- (IV) (a) **Five Percent (5%)** of Ex-Works Price Component of the Contract Price on **Completion of the Facilities including all associated auxiliaries and ancillary works** and issue of Completion Certificate by the Project Manager.
- (b) **Five Percent (5%)** of Ex-Works price component of the Contract Price on Successful **Completion of Guarantee Tests** and issuance of Operational Acceptance Certificate by the Project Manager.

Notes: The basis for the pro-rata payments at S. No. (II) & (III) above shall be the Billing Break-up (BBU) to be finalized subsequently after award of Contract.

The Billing Break Up shall be generally on item rate basis.

However, for the items which are generally supplied and billed on weight (tonnage) basis, the Billing Break-Up may be considered on weight (tonnage) basis.

In case Installation Price (Excluding Civil/Site Fabricated Structural works price) is less than 15% of the cumulative total of FOB & Ex-works Price of Main Equipment, the amount by which it is lower shall be retained proportionately from the FOB & Ex-works component of Contract Price while releasing payments due on receipt of equipment, and no interest shall be payable on the retained amount. The aforesaid retained amount shall be paid on pro-rata basis upon completion of installation of the respective equipment and its certification by the Project Manager.

C. Schedule 1, Schedule 2 and Schedule 6: Payment Terms for Mandatory Spares and Recommended Spares (When ordered) quoted on CIF (Port of Entry)/Ex-Works (India) basis:

The Ex- works (India) price of spares to be supplied from within the Employer's country shall be paid as under:

- (i) **Seventy five percent (75%)** of CIF/Ex-works price component of the spares to be paid on pro-rata basis: upon dispatch to site and against production of invoices and shipping documents along with Material Dispatch Clearance Certificate (MDCC) issued by Employer's QA & I representative.
- (ii) **Twenty five percent (25%)** of CIF/Ex-works price component of the spares to be paid on pro-rata basis: on receipt and storage at site and on physical verification and certification by the Project Manager for the spares received and stored at site.

D. Schedule No. 2: Local Transportation

a) All Plant and Equipment including mandatory spares and recommended spares (if ordered)

Hundred Percent (100%) of Local Transportation charges (including port clearance, port handling and port charges etc., if applicable, and inland transit insurance charges) for the plant and equipment including mandatory spares and also recommended spares (if ordered) shall be paid to the Contractor pro-rata to the value of the equipment/spares received at site and on production of invoices by the Contractor. The aggregate of all such pro-rata payments shall, however,

not exceed the total amount identified in the Contract for Local Transportation. However, where item wise local transportation charges (including port clearance, port handling and port charges etc., if applicable, and inland transit insurance charges) have been identified in the Contract, the payment for the same shall be made after receipt of the equipment/spares at site, based on the charges so identified in the Contract.

E. Schedule No. 4: Installation Services

The Total Installation Services Component of the Contract Price of Plant and Equipment shall be paid as under:

(IA) Five Percent (5%) of the total Installation Services component of the Contract Price will be paid to the Contractor as interest bearing initial advance payment on:

- (i) Acceptance of Notification of Award and Signing of Contract Agreement.
- (ii) Establishing their office at site preparatory to mobilization of their erection establishment.
- (iii) Submission of an unconditional Bank Guarantee for an amount equivalent to one hundred ten percent (110%) of the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid up to ninety (90) days beyond the schedule date for Completion of the last Facility covered under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this advance Bank Guarantee shall be extended by the period of such delay. The proforma of the Bank Guarantee is enclosed in Section-VII-Bank Guarantee Form for Advance Payment.
- (iv) Submission by the Main Contractor of an unconditional Bank Guarantee(s) towards Performance Security(s) in respect of all Contracts (including the Contracts entered into with the Contractor's Assignee, if applicable in case of foreign contractor) and submission by the Assignee (if applicable in case of Foreign Contractor) of an unconditional Bank Guarantee(s) towards Performance Security(s) in respect of all Contracts entered into with the Assignee, all initially valid up to ninety (90) days after the end of Defects Liability Period of all equipments covered under the Contract. The proforma of Bank Guarantee is enclosed in Section-VII-Form of Performance Security.
- (v) VOID
- (vi) Submission of a detailed PERT Network based on the work

schedule stipulated in Appendix - 4 to the Form of Contract Agreement and its approval by the Employer.

- (vii) Advance Payment for Installation services price components shall be released after certification of Engineer-in-Charge that the Contractor has brought to site the Safety equipment's & Safety Personal Protective Equipment's as per minimum quantity specified in the Bidding Documents.

In case the Contractor decides not to take advance payment, the first progressive payment for Installation services price component shall be released after certification of Engineer-in-Charge that the Contractor has brought to site the Safety equipment's & Safety Personal Protective Equipment's as per minimum quantity specified in the Bidding Documents.

(IB) Further, Five Percent (5%) of the total installation services component of the Contract Price will be paid to the Contractor as interest bearing initial advance payment on:

- (i) Fulfillment of Conditions mentioned at E(IA)(i) to (viii) above
- (ii) Submission of an unconditional Bank Guarantee for an amount equivalent to one hundred ten percent (110%) of the advance amount plus GST as applicable on the advance payment to be paid to the contractor, which shall be initially kept valid up to ninety (90) days beyond the schedule date for Completion of the last Facility covered under the Package. However, in case of delay in completion of the facilities covered under the package, the validity of this advance Bank Guarantee shall be extended by the period of such delay. The proforma of the Bank Guarantee is enclosed in Section-VII-Bank Guarantee Form for Advance Payment.
- (iii) T&P and manpower mobilization as identified along with PERT Network for start of erection and certification thereof by the Engineer-in-Charge.
- (IC) The recovery of the interest component on the advance amount shall be made from the progressive payments released to the Contractor as per Clause E(II) of APPENDIX-I to Form of Contract Agreement, Section-VII. The amount of interest to be recovered from a particular bill shall be calculated "**SBI 1-year MCLR as on 01st April of applicable year + 150 bps**" per annum on the value advance corresponding to the %age of total progressive payment being released. The period for which the interest is to be calculated shall be reckoned from the date of release of the advance payment to the actual date of release of the said progressive payment or the expiry of the stipulated time frame for release of such progressive payments under the contract, whichever is earlier. The interest on the advance payment shall stand fully recovered on release of all the progressive payments. If the amount payable under any interim bill is not sufficient to cover all deductions to be made for interest on the advance payment and other sums deductible therefrom, the balance outstanding shall be recovered from the next payments immediately falling due.

Note: In case the contractor decides not to take interest bearing advance payment, the advance payment shall be proportionately adjusted in the balance payments excluding final payment (i.e. in the progressive payment of 80%).

- (II) **Eighty Percent (80%)** of the Installation Services component of Contract Price (excluding Civil and Structural works) shall be paid on pro-rata basis against progressive erection of the identified equipment on certification by the Project Manager for the quantum of work completed and on certification by the Project Manager's field quality assurance & surveillance representative for the successful completion of quality check points involved in the quantum of work.

Note: The release of first progressive payment for installation services shall also be subject to submission of documentary evidence by the Contractor towards having taken the insurance policy(ies) in terms of relevant provisions of GCC Clause 34 (Insurance) and acceptance of same by the Project Manager.

- (III) (a) **Five Percent (5%)** of total Installation Services Component of Contract Price **on Completion of the Facilities including all associated auxiliaries and ancillary works** and issue of Completion Certificate by the Project Manager.
- (b) **Five Percent (5%)** of total installation Services Component of Contract Price **on successful completion of guarantee Tests** and issue of Operational Acceptance Certificate by the Project Manager.

Note: In case, Installation Services component of Contract Price includes foreign currencies, the payment at each stage as above, shall be made in the stated currencies on proportionate basis for the items of work involving foreign currency.

The basis for the pro-rata payments at Sl.No. (II) above shall be the Billing Break up to be finalized subsequently based on the following guidelines :

The billing break up shall be on weight (tonnage) basis.

However, for the items which are generally supplied, erected and billed an item rate basis, the billing break up may be considered on item rate basis.

In case the contractor is a nonresident / foreign company, the release of first progressive payment shall also be subject to submissions of certificate / Ruling determining the applicable rate of Income Tax in terms of Relevant provisions of GCC clause on Taxes & Duties and acceptable of the same by the Engineer-in Charge.

In case 'Amount linked to Installation Services' is less than 2% of the cumulative total of supply portion of contract, the amount by which it is lower shall be retained proportionately from the other components of Schedule-1 & 2 of the Contract price while releasing payments of each RA bill. No interest shall be payable on the amounts linked to Installation Services including aforesaid retained amount. The amounts linked to Installation Services including aforesaid retained amount shall be payable in part or full based on Installation completion duly certified by Project Manager on quarterly basis.

F. *Payment terms for Price Adjustment Amount-*

Any addition due to adjustment to the Contract Price shall be payable in the similar manner as provided in the clauses A to F above. The price adjustment amount corresponding to advance payment shall be clubbed with the first progressive payment of that equipment. Reduction to the Contract Price, if any, due to price adjustment provisions, shall be effected by recovering 100% of the reduction amount (including advance) from any of the Contractor's bills falling immediately due for payment.

G. *Schedule - 7 : Payment Terms for Taxes & Duties*

100% of applicable Taxes and Duties which are payable by the Employer under the Contract shall be paid/reimbursed to the Contractor upon receipt of equipment/spares/services and on production of satisfactory documentary evidence by the Contractor. However, GST as applicable on Advance payment shall be paid to the Contractor along with the Advance sanctioned. The GST paid along with advance shall be adjusted prorata against the tax due upon supply of goods/services, based on the value of the respective goods / services.

H. *Schedule No. 4: Amount linked to Safety Aspects/ compliance to Safety Rules*

- I. The amount linked to Safety Aspects/ compliance to Safety Rules shall be paid in two parts, viz,**
- A) 10% amount (calculated as 0.1 Y of the service portion amount of RA bill) shall be linked to Fatal/Major Accidents, and
 - B) 90% amount (calculated as 0.9 Y of the service portion amount of RA bill) shall be linked to various Safety Aspects specified in Safety Rules of NTPC.

NOTE:

Amount linked to Safety Aspects/ Compliance to Safety Rules specified in Price Schedule

$$Y = \frac{\text{Total amount for Service Portion of the Contract, i.e. Civil + Installation/ Erection + Structural Works}}{\text{Total amount for Service Portion of the Contract, i.e. Civil + Installation/ Erection + Structural Works}} \times 100$$

Total amount for Service Portion of the Contract, i.e. Civil + Installation/ Erection + Structural Works

- II. While raising each RA Bill, Contractor shall claim Amount linked to Safety Aspects/ Compliance to Safety Rules in such a manner that amount claimed is equal to Y% of the service portion (Civil + Installation/ Erection + Structural Works) of RA Bill.
- III. The amount as elaborated at para G. I. shall be withheld from first and second monthly RA bill of the respective quarter/three month period and shall be released in part or full based on safety compliance duly certified by Project Manager and Safety-in-charge on quarterly basis. The amount for the entire quarter (i.e. RA bills raised during a 3 month period) shall be paid to the Contractors at the end of that three months period along with 3rd/last RA Bill for the quarter/three months period upon complying the following conditions:
- A) **Amount of RA Bill linked to Fatal/ Major Accidents (0.1Y as elaborated above at para G.I.A)**

Aforesaid amount (on quarterly basis) shall be payable to Contractor only in case, there is

- i) No fatal injury or accident-causing death in that three month period
and
- ii) No Major injury or accident causing 25% or more permanent disablement to workmen or employees in that three-month period. Permanent disablement shall have the same meaning as indicated in The Workmen's Compensation Act' 1923.

In case of any fatal injury or accident as elaborated above occurs during that three-month period, the stipulated amount (0.1Y) subject to minimum of **Rs 10 Lakh per fatality** shall be forfeited and shall not be payable to the Contractor under the contract. In case, the amount to be deducted/forfeited exceeds the amount linked to Fatal/ Major Accidents, the same shall be recovered from remaining Amount (0.9Y) linked to Compliance of Safety Rules and/or any other payments immediately due to the Contractor under the Contract.

In case of any Major injury or accident causing 25% or more permanent disablement to workmen or employees occurs during that three month period, **Rs 4 lakh per Major injury** shall be deducted from the amount (0.1Y) linked

to Fatal/ Major Accidents and shall not be payable to the Contractor under the contract. In case, the amount to be deducted/forfeited exceeds the amount linked to Fatal/ Major Accidents, the same shall be recovered from remaining Amount (0.9Y) linked to Compliance of Safety Rules and/or any other payments immediately due to the Contractor under the Contract.

Further, in case, Contractor doesn't raise RA Bills in any three-month period/quarter and if any fatal injury and/or major accident takes place in that period, Project Manager shall deduct the amount [Rs 10 Lakh per fatality and Rs 4 lakh per Major injury] pertaining to this particular quarter from his next RA bill/due payment. In case, the amount to be deducted/forfeited exceeds the amount linked to Safety, the same shall be recovered from any other payments immediately due to the Contractor under the Contract.

The amount deducted/forfeited as mentioned above shall be in addition to the compensation payable to the workmen / employees under the relevant provisions of the Workmen's Compensation Act' 1923 and rules framed there under or any other applicable laws as applicable from time to time.

B) Amount of RA Bill linked to Compliance of Safety Rules (0.9Y i.e. 90% of amount as elaborated above at para G.I.B)

Aforesaid amount (on quarterly basis) shall be payable to Contractor in five equal parts under five heads as under:

(i) Amount payable on deployment of required Safety Personnel

One fifth of the amount specified at G.III.B (calculated as 0.18Y of Service portion amount of RA Bill), on quarterly basis, shall be paid upon certification by Project Manager in consultation with Safety dept. that required number of Safety personnel as per Clause 2.3 of 'NTPC Safety Rules for Construction and Erection of Power Plants' [as enclosed with GCC/SCC] have been deployed. The aforesaid amount linked to deployment of requisite safety personnel shall be paid as under:

- a) 50% of the amount referred to at G.III. B.(i), for deployment of Safety Supervisors shall be paid on pro-rata basis depending upon the actual no. of Safety Supervisors deployed vis-à-vis actual requirement:

Amount to be paid = 0.09Y x Service portion of RA bill amount x (a/b)

Where 'a' is actual no. of Safety supervisors deployed

and

'b' is required no. of Safety supervisors as per Safety Rules.

In case, actual no. of Safety supervisors deployed is more than requisite number (i.e. a/b is more than 1), the amount to be paid shall be restricted to 0.09Y.

- b) 50% of the amount referred at G.III.B.(i), for deployment of Safety Officers shall be paid on pro-rata basis depending upon the actual no. of Safety Officers deployed vis-à-vis actual requirement :

Amount to be paid = 0.09Y x Service portion of RA bill amount x (a/b)

Where 'a' is actual no. of Safety Officers deployed

and

'b' is required no. of Safety Officers as per Safety Rules.

In case, actual no. of Safety Officers deployed is more than requisite number (i.e. a/b is more than 1), the amount to be paid shall be restricted to 0.09Y.

- c) In case aforesaid requisite no. of Safety personnel are not deployed by Contractor, amount not to be paid as calculated above for that particular quarter/three month period shall be forfeited and shall not be payable to the Contractor under the contract.

- (ii) Amount payable on providing requisite Personal Protective Equipment & Safety Equipment

One fifth of the amount specified at G.III.B (calculated as 0.18Y of Service portion amount of RA Bill), on quarterly basis, shall be paid upon certification by Project Manager in consultation with Safety dept. that Contractor has adhered to the requirements of Clause 4 (Personal Protective Equipment) of 'NTPC Safety Rules for Construction and Erection of Power Plants' and the provisions of the Bidding Documents with regards to number of Safety Equipment/PPEs to be provided by the Contractor.

In case of non-compliance by Contractor, warning letter/Non-compliance shall be issued by Project Manager /Safety Officer of NTPC as per clause 22.3.3 (ii) of GCC. Further, if more than two such warning letters/Non Compliance Memos are issued in a quarter/three monthly

period, above mentioned amount for that particular quarter/three month period shall be forfeited and shall not be payable to the Contractor under the contract.

(iii) Amount payable on providing requisite Safety Induction and Training

One fifth of the amount specified at G.III.B (calculated as 0.18Y of Service portion amount of RA Bill), on quarterly basis, shall be paid upon certification by Project Manager in consultation with Safety dept. that Contractor has adhered to the requirements of imparting Safety training as per Clause 8.0 (Safety Induction and Training) of 'NTPC Safety Rules for Construction and Erection of Power Plants to at least 90% of its employees/workmen (who have not been previously provided with requisite training) in a quarter/ three months period.

In case Contractor fails in meeting the aforesaid requirement, above mentioned amount for that particular quarter/three month period shall be forfeited and shall not be payable to the Contractor under the contract.

(iv) Amount payable on providing requisite Medical and First Aid Amenities

One fifth of the amount specified at G.III.B (calculated as 0.18Y of Service portion amount of RA Bill), on quarterly basis, shall be paid upon certification by Project Manager in consultation with Safety dept. that Contractor has adhered to the requirements of Clause 13 (Medical and First Aid Amenities) of 'NTPC Safety Rules for Construction and Erection of Power Plants'.

In case Contractor fails to provide Medical and first aid amenities as per requirement of aforesaid Clause 13 even on one incidence in any quarter/three month period, above mentioned amount for that particular quarter/three month period shall be forfeited and shall not be payable to the Contractor under the contract.

(v) Amount payable on compliance to Work Permit System

One fifth of the amount specified at G.III.B (calculated as 0.18Y of Service portion amount of RA Bill), on quarterly basis, shall be paid upon certification by Project Manager in consultation with Safety dept. that Contractor has adhered to the requirements of Clause 17 (Work Permit System) of 'NTPC Safety Rules for Construction and Erection of Power Plants'.

In case of non-compliance by Contractor, warning letters/Non Compliance Memos shall be issued by Project Manager /Safety Officer of NTPC as per clause 22.3.3 (v) of GCC. In case of issuance of more

than two such warning letters/Non Compliance Memos in a quarter/three monthly period, above mentioned amount for that particular quarter/three month period shall be forfeited and shall not be payable to the Contractor under the contract.

- IV.** In case 'Amount linked to Safety Aspects / compliance to Safety Rules' is less than **2%** of the cumulative total of Service Portion of the Contract, i.e. Civil + Installation/ Erection + Structural Works, the amount by which it is lower shall be retained proportionately from the other components of Schedule-3/4** of the Contract price while releasing payments of each RA bill. No interest shall be payable on the amounts linked to Safety Aspects / Compliance to Safety Rules including aforesaid retained amount. The amounts linked to Safety Aspects / Compliance to Safety Rules including aforesaid retained amount shall be payable in part or full based on safety compliance duly certified by Project Manager and Safety-in-charge on quarterly basis.

(If Prices are quoted in foreign currency then SBI Bills Selling exchange rate as on the date set for submission of Price bids shall be considered for the purpose of computing installation percentage /retention amount).

- I.** **Schedule - 8 (as applicable)** : 100% of each Type Test Charges along with service tax (if payable under the contract) shall be paid to the Contractor upon conductance of the corresponding Type Test and Certification by the Engineer there on.

(If Prices are quoted in foreign currency then SBI Bills Selling exchange rate as on the date set for opening of Price Bids shall be considered for the purpose of computing charges percentage /retention amount).

- J.** An Additional Advance up to 5% of the Ex works/Installation Services (including Civil Works) price component, apart from the Advance already provided for in the specified Terms of Payment, may be paid to the Contractor which shall be interest bearing and against Bank Guarantee of 110% of the advance requested

and covering the interest charges. The advance amount shall be provided during various phases of Contract execution to meet the requirement of payment by the Contractor to the contractor's sub-vendors/sub-contractors but in aggregate shall not exceed 5% of the Ex works/Installation Service (including Civil Works) Price Component. The advance amount shall be released in Indian Rupees only and Tax implication, if any, shall be to the account of the Contractor.

While applying for advance under this provision, the contractor shall provide a statement of past payment utilization evidencing the need for cash flow support and also plan for utilization of the amount requested as per above. The advance shall be provided in exceptional circumstances to enable work to be carried out. The advance amount shall be transferred to an ESCROW account (to be opened

by the Contractor in any Scheduled Bank of India under intimation to the Employer) and after availing the advance, the contractor will be required to submit proof of utilization, as per the recovery plan submitted to Employer.

The advance amounts shall be interest bearing and rate of interest to be notified by Employer from time to time. This advance shall not be lump sum advance, but shall be provided in phases to tide over the financial constraints being faced by the contractor, along with the progress of work. The requirement of this advance shall be with the approval of the Employer Head of Project.

The recovery of the interest component on the advance amount shall be made from subsequent progressive payments to be released to the contractor.

The period for which the interest to be calculated, shall be reckoned from the date of release of the Additional Advance(s) to the actual date of release of subsequent progressive payments as per the Plan to be agreed with the Contractor.

The advance Amount shall be recovered from the milestone payments to be agreed between Employer and the Contractor.

(The Format of Escrow Agreement for aforesaid Additional Advance Payment is enclosed As Annexure-III to This Appendix-I)

PAYMENT PROCEDURES

The Procedures to be followed in making application for, certifying and making payments shall be as follows:

1. **Payment Schedule/Price Break-up for Payments**

- 1.1 The Contractor shall prepare and submit to the Employer for approval, a break-up of the Contract Price in the currencies of the Contract. It is expected that the Contractor shall indicate the price of a single item in one currency only. However, if the Contractor intends to receive payment for some items in more than one currency, the Contractor would be required to furnish a separate breakup and the payment for such items shall be made based on the agreed rates. The Contract Price break-up shall be interlinked with the agreed detailed PERT Network of the Contract setting forth starting and completion dates for the various key phases of the Facilities. Any payment under the Contract, subsequent to Advance payment, shall be made only after the Contractor's price break-up is approved by the Employer. The aggregate sum of the Contractor's price break-up shall be equal to the Total Contract Price.
- 1.2 The Billing Breakup for Mandatory Spares shall be submitted to the Employer for approval as per the format enclosed as Annexure-1 to this Appendix indicating therein the details such as Make, Model number, Drawing/Datasheet number and Part number of all spare items. The relevant drawings/documents shall be submitted along with the Billing Break up.
- 1.3 The Contractor shall, by the 15th April of every year, furnish the BBU value of supplies sourced from Micro and Small Enterprises (MSEs) along with the total BBU value of supplies dispatched by it during the preceding financial year as per the format enclosed as Annexure-2 to this APPENDIX-1.

2. **Currency of Payment**

- 2.1 The Contract Price shall be paid in the currency or currencies in which the various price components have been stated and as incorporated in the Contract.

3. **Application for Payment**

- 3.1 The Contractor shall submit application for the payment in the proforma enclosed. The Contractor shall submit to the Project Manager separate applications for payment in different currencies whenever payment is to be made in more than one currency.
- 3.2 Each such application shall state the amount claimed and shall set forth in details, the order of the Payment Schedule, particulars of the Facilities including

the Facilities executed at Site and of the equipments shipped/brought on to the Site pursuant to the Contract up to the date mentioned in the application and for the period covered since the last preceding certificate, if any.

- 3.3 Every interim payment certificate shall certify the Contract Value of the Facilities executed upto the date mentioned in the application for the payment certificate, provided that no sum shall be included in any interim payment certificate in respect of the Facilities that according to the decision of the Project Manager, does not comply with the Contract, or has been performed, at the date of certificate prematurely.
- 3.4 In case the Contractor is a nonresident/foreign company, the release of first progressive payment shall also be subject to submission of Certificate from Indian Tax Authority or Ruling determining the applicable rate of Income Tax in terms of relevant provisions of GCC clause on Taxes & Duties and acceptance of same by the Engineer-in-Charge.

4. *Due Dates for Payment*

- 4.1 The advance payment amount shall be payable after fulfilment of all the conditions laid down in the Terms of Payment (Appendix 1 to the Contract Agreement) and receipt of the Contractor's invoice along with all necessary supporting documents for such advance payment. Employer will make progressive payment as and when the payment is due as per the Terms of Payment set forth in Appendix 1 to the Contract Agreement. Progressive payment other than that under the Letter of Credit will become due and payable by the Project Manager within forty five (45) days from the date of receipt of Contractor's bill/invoice/debit note by the Employer, provided the documents submitted are complete in all respects.

5. *Mode of Payment*

- 5.1 The Employer will establish an irrevocable Letter of Credit (L/C) in favour of the Contractor through the Employer's Bank in Employer's country for payments due, as per Terms of Payment, on despatch of equipments including Mandatory Spares i.e. Ex-Works / CIF despatch of equipments including Mandatory Spares (including due payments towards Ocean Freight and Marine Insurance). The value of L/C will be as per payment schedule for each quarter and valid for a quarter. It will be the responsibility of the Contractor to utilize the L/C to the fullest extent. In case L/C has been established by the Employer and not utilized by the Contractor, for reasons of delay attributable to him, all reinstatement charges for the L/C for further period necessitated due to non-utilization of L/C will be to the account of the Contractor.

5.2 The payment of the advance amount, Type Test Charges if any, price adjustment amounts, all other supply payments, taxes and duties (wherever admissible) inland transportation (including port handling if any) insurance and the Installation Portion of the Facilities including Civil, Structural and Allied Works (if any), shall be made direct to the Contractor by the Employer and no L/C shall be established by the Employer for such payments. Wherever technically feasible, such payments shall be made electronically only as per details of Bank Account indicated in the contract. In case of any changes to the bank account indicated in the contract, the contractor shall immediately inform the employer. The Contractor shall hold the employer harmless and employer shall not be liable for any direct, indirect or consequential loss or damage sustained by the bidder on account of any error in the information or change in Bank details provided to the employer in the prescribed form without information to employer duly acknowledged.

6. *For Payments related to Erection / Civil / Site Fabricated Structural Works*

The Contractor shall maintain a separate account with a Scheduled Bank at Site for the purpose of receiving all the payments under the Contract(s) and for utilization of payments received from the Employer for disbursement to sub-contractors, sub-vendors, PRW's etc., of the Contractor. The Contractor shall maintain separate books of accounts for all payments under this Contract and the Project Manager shall have access to these at all times.

FORM OF APPLICATION FOR PAYMENTS

Project :
Equipment Package : Date :
Name of Contractor : Contract No. :
Contract Value : Contract Name :
Unit Reference : Applicable Serial
To. Number :

.....*

(Name of Employer)

Dear Sir

APPLICATION FOR PAYMENT

1. Pursuant to the above referred Contract Agreement dated.....
the undersigned hereby applies for payment of the sum of
..... (Specify amount and currency in which claim is
made).

2. The above amount is on account of : (check which ever
applicable) Advance payment (Schedule**)

Interim payment as advance (Schedule **)

Progressive payment against despatch of equipment (Schedule **)

Progressive payment against receipt of equipment (Schedule **)

Progressive payment against Installation (Schedule **)

Inland transportation (Schedule **)
Inland insurance

Price adjustment

Extra work not specified in contract
(Ref. Contract change order No.)

Others (specify)

Final payment (Schedule **)

as detailed in the attached schedule(s) which form an integral part of this application.

3. The payment claimed is as per item(s) No.(s)..... of the payment schedule annexed to the above mentioned Contract.

4. The application consists of this page, a summary of claim statement(Schedule **), and the following signed schedules

1

2

3

The following documents are also enclosed:

1

2

3

Signature of Contractor/
Authorized Signatory

* Application for payment will be made to 'Project Manager' as to be designated for this purpose at the time of Notification of Award.

** Proforma for the Schedules will be mutually discussed and agreed to during the finalization of the Contract Agreement.

ANNEXURE-1 TO APPENDIX-1

PROJECT:	ANDMAN & NICOBAR GAS POWER PROJECT	CLIENT:	.....
PACKAGE:	ANDMAN & NICOBAR GAS POWER PROJECT (50MW)		
TITLE:	BILLING BREAK UP FOR MANDATORY SPARES	CONTRACTOR:	.....
NOA REF :			
BILLING BREAK UP (BBU)	.....	
NO. :			

SI.No.	Description	Quantity	Unit	Unit Price	Total Price	Equipment Make	Equipment Model	Drawing / Documents/Data Sht no.	Part No.	Remarks

Annexure-2 to APPENDIX-1

Proforma for details to be furnished by the Contractor by 15th April of every financial year of supplies sourced from MSEs dispatched during the preceding financial year.

Package Name:
Project Name:
Name of the Contractor:
COA No.:

Details of BBU value of supplies dispatched during the preceding financial year are furnished here below:

BBU value of total supplies dispatched (A) (in eqvt INR)	Out of the total supplies dispatched, BBU value of supplies sourced from MSEs (B) (in eqvt INR)	Percentage of supplies sourced from MSEs wrt total supplies dispatched (C = B*100/A) (%)
.....

In case of no supplies sourced from MSEs, mention „NIL“.

I, on behalf of M/s (*Contractor*) hereby declare that the information furnished above is correct.

Signature.....
Name.....
Designation and Seal.....

PRICE ADJUSTMENT

- (i) The Contract price shall be subject to price adjustment during performance of the Contract to reflect changes in the cost of labour and material components etc. in accordance with the provisions described below:
- (ii) The price adjustment provisions shall be applicable separately for price components relating to Supply of Equipment including spare parts, Installation, Civil and Structural Works, as per price break-up furnished by the Contractor in Schedule-1/ Schedule-2/ Schedule-6 and Schedule-4. The Price Adjustment shall be without any Ceiling.
- (iii) Only following components of the Contract Price will be subject to Price adjustment:
 - (a) Ex-Works (India) Price of Plant and Equipment including Mandatory Spares manufactured within the Employer's Country, but excluding Type Tests Charges (covered in Schedule 2) and FOB Price Component for Plant and Equipment including Mandatory Spares supplied from abroad, but excluding Type Tests Charges (covered in Schedule 1).
 - (b) Installation Price Component of Contract Price (covered in Schedule 4) consisting of Erection portion.
 - (c) Civil Works price component of Contract Price (covered in Schedule-4) excluding Demolition of existing structures (if applicable) price.
 - (d) Site Fabricated Structural Works price component of Contract Price (covered in Schedule-4).
 - (e) Ex-Works (India) Price of Recommended Mandatory Spares manufactured within the Employer's Country and FOB Price Component for Recommended Mandatory Spares supplied from abroad (both covered in Schedule 6)."
- (iv) Price adjustment amounts towards aforesaid components of Contract Price shall be paid in the respective currencies of Contract.
- (v) The indices for price adjustment shall necessarily be of the country of origin of goods/labour and shall be well established and nationally recognised in that country. Preferably Government indices shall be used.
- (vi) The price adjustment formula for the components of the Contract Price, as mentioned at Sl.No. (iii) above shall be as stipulated hereinafter.
- (vii) **Ex-Works/ FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges"**

It is understood that the price component of the equipments for any shipment/despatch comprises of a fixed portion (designated as 'F' and the value of which is specified hereunder) and a variable portion linked with the indices for various materials and labour (description and co-efficients as enumerated below).

The amount of price adjustment towards variable portion payable/recoverable on each

shipment/despatch shall be computed as under:

$$EC = EC_1 - EC_0$$

EC₁ will be computed as follows :

$$EC_1 = EC_0 \left\{ F + a \times \frac{A_1}{A_0} \times f_1 + b \times \frac{B_1}{B_0} \times f_2 + c \times \frac{C_1}{C_0} \times f_3 + \dots \right. \\ \left. + Lb \times \frac{L_1}{L_0} \times f_{Lb} \right\}$$

Where

EC = Adjustment to Ex-Works/FOB Price Component expressed in the currency of the Contract payable to the contractor for each shipment/despatch.

EC₁ = Adjusted Amount of Ex-Works/FOB Price Component expressed in the currency of the Contract payable to the Contractor for each shipment/despatch.

EC₀ = Ex-Works/FOB Price for the plant and equipments in the currency of the Contract, shipment/dispatch wise.

- The fixed portion of the Ex-Works/FOB Component of the Contract Price (F) shall be 0.15.
- a,b,c etc. shall be co-efficients of major materials/items involved in the Ex-Works/FOB Component of the Contract Price. The sum of these co-efficients shall be between 0.50 to 0.60.
- A,B,C etc. shall be published price indices of corresponding major materials/items. Such indices shall necessarily be of the country of origin of goods.
- 'Lb' shall be co-efficient for labour component in the Ex-Works/FOB Component of the Contract Price which shall be between 0.25 to 0.35.

'L' shall be labour index.

- Sum of all the material co-efficients and the labour co-efficient shall be 0.85.

f₁, f₂, f₃ etc. are Exchange Rate Correction Factors for the respective materials and f_{Lb} is the Exchange Rate Correction Factor for labour with reference to the currency of the country of origin of index and the respective Contract currency, such that

$$f = \frac{Z_0}{Z_1}$$

where Z is the no. of units of the currency of the country of the origin of index, which is equivalent to one unit of the respective Contract currency. The exchange rates to be used for calculation of factor 'f' shall be as per Bills Selling Exchange Rates established by the STATE BANK OF INDIA.

For the indices, subscript 'o' refers to indices as on 30 days prior to deadline for submission of bids. For 'Z₀' subscript 'o' refers to value as on the date of submission

of Envelope-I (Techno-commercial) bids.

Subscript '1' refers to indices/exchange rates as of :

- (a) three months (for Labour Indices) /ninety (90) days (for Exchange Rates) prior to the date of shipment/despatch for labour and Exchange Rates respectively, and
- (b) at the expiry of two third (2/3) period from the date of Notification of Award to the date of shipment/despatch, for material.

For the purpose of this clause the date of shipment/despatch shall mean the schedule date of shipment/despatch or actual date of shipment/despatch, whichever is earlier. The schedule date of shipment/despatch shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

In case of shipments/dispatches which are delayed beyond the schedule date of shipment/despatch for reasons attributable to the Contractor the price adjustment provision shall not be applicable for the period of time between the schedule date of shipment/despatch and the actual date of shipment/despatch. For this purpose, the schedule date of shipment/despatch shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

The above formula for price adjustment will be applicable if the currency in which the Contract Price is expressed is different from the currency of the country of origin of labour and material indices. In other cases, formula shall be applied without the Exchange Rate Correction Factor 'f'.

(viii) For Installation Price Component (excluding Civil Works and Site Fabricated Structural Works component) of the Contract:

- i) It is understood that the price component for erection portion of Installation Services comprises a fixed portion and variable portion linked with the index of labour (description and co-efficients as enumerated).

The monthly price adjustment amount for the erection portion of Installation Services component will be computed as per the formula given below :

a) Indian Rupee Portion of the Installation Services

$$ER = ER1 - ER_0$$

ER1 will be computed as follows :

$$ER1 = ERo (0.15 + 0.5 \times \frac{L_1}{Lo} + 0.5 \times 0.85 \times \frac{W_1}{Wo})$$

Where :

ER = Adjustment to Erection portion of Installation Services component of contract price expressed in Indian Rupees payable to the contractor for each billing.

ER1 = Adjusted amount of Erection portion of Installation Services component of contract price expressed in Indian Rupees payable to the Contractor.

ER0 = Value of the Erection work done in the billing period, which shall be calculated as under:

For the purpose of computing ERo, each Erection bill (which is excluding Advance and amount payable on successful completion of **Trial**/Initial Operation and on successful completion of Guarantee test) during the Erection period upto the 'Completion of the Facilities' shall be divided by a factor as indicated below:

Erection portion of Installation - [Advance amount + Erection Services component of the Contract Price	- [Advance amount + Erection Services component of the Contract Price payable on successful completion of Trial /Initial Operation + Erection Portion of Installation Services component of the Contract Price payable on successful completion of Guarantee test]
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Erection Portion of Installation Services component of the Contract Price

The payment of price adjustment amount so computed (refer Sr.No. H, Appendix-1) shall be made against a separate invoice, linking the corresponding invoice for Erection Portion of Installation Services payment after retaining the pro-rata amount due on successful completion of **Trial**/Initial Operation and on Completion of the Guarantee Test. The amounts so retained shall be paid on successful completion of **Trial**/Initial Operation and on successful completion of Guarantee Test respectively.

L = Indian field labour Namely, All India Consumer Price Index for Industrial Workers (All India Monthly Average) as published by Labour Bureau, Simla, Government of India.

F = Fixed Price component =0.15

W = The other Index for Indian field labour Namely, **Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher**

Subscript 'o' refers to indices / minimum wages as on 30 days prior to deadline for submission of bids

Subscript '1' refers to the indices / minimum wages as applicable for the month of execution of the Installation work.

In case there is a revision in the applicable minimum wages during a month, calculation of 'W1' would take into consideration the weighted average of the applicable wages (wage before revision and wage after revision) and the number of days of applicability of such wages in the month.

For the purpose of this clause, month of execution of installation work shall mean the schedule month of execution of the installation work or actual month of execution of the installation work, whichever is earlier. The schedule date for completion of a particular installation activity shall be as identified in line with provisions of Time schedule, Appendix-4 to the Contract Agreement.

In case of installation activities which are delayed beyond the schedule date for reasons attributable to the contractor, the price adjustment provision shall not be applicable for the period of time between the schedule date of completion and actual date of completion of the respective installation activity. For this purpose, the schedule date for completion of a particular installation activity shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

(b) Foreign Currency Portion of the Installation Services

$$EE = EE_1 - EE_0$$

EE₁ will be computed as follows :

$$EE_1 = EE_0 (0.15 + 0.85 \frac{EF_1}{EF_0} \times f)$$

Where

EE = Adjustment to Installation Services Component of Contract Price expressed in foreign currency payable to the contractor for each billing.

EE₁ = Adjusted Amount of Installation Services Component of Contract Price expressed in foreign currency payable to the contractor for each billing.

EE₀ = Value of foreign currency portion of Erection Work done in the billing

period which shall be calculated as under :

For the purpose of computing EE_0 , each bill (which is excluding

Advance and amount payable on successful completion of **Trial/Initial Operation** and on successful Completion of the Guarantee Tests) during the Erection period upto the 'Completion of the Facilities' shall be divided by a factor as indicated below:

Installation Component of the - Price	[Advance Amount + Insta- Contract llation Component of the Contract Price payable on successful completion of Trial/Initial Operation + Installation Component of the Contract Price payable on successful completion of Guarantee Tests]
--	---

Installation Component of the Contract Price

The payment of price adjustment amount so computed (refer S.No. H, Appendix-1) shall be made against a separate invoice, linking the corresponding invoice for Erection Portion of Installation payment after retaining the pro-rata amount due on successful completion of **Trial/Initial Operation** and on Completion of the Guarantee Tests. The amount so retained shall be paid on successful completion of **Trial/Initial Operation** and on successful completion of the Guarantee Tests respectively.

EF = Index for Expatriate Field Labour Component of the Erection Price of Installation Work. Such index shall necessarily be of the country of nationality of the labour.

f = Exchange Rate Correction Factor for Expatriate Labour with reference to currency of country of origin of index for expatriate labour and the respective Contract currency, such that

$$f = Z_0 / Z_1$$

where Z is the no. of units of the currency of the country of origin of index, which is equivalent to one unit of the respective Contract currency. The exchange rates to be used for calculation of factor 'f' shall be as per Bills Selling Exchange Rates established by the STATE BANK OF INDIA.

For the indices, Subscript 'o' refers to indices as on 30 days prior to deadline for submission of bids. **For 'Z_o', subscript 'o' refers to value as on the date of submission of Envelope-I (Techno-commercial bids).**

For the indices, subscript '1' refers to the indices as applicable for the month of execution of the erection work. In case there is a revision in the applicable minimum wages during a month, calculation of 'W₁' would take into consideration the weighted average of the applicable wages (wage before revision and wage after revision) and the number of days of applicability of such wages in the month. **For the exchange rates, subscript '1' refers to the exchange rates as applicable on the last day of the month of execution of the erection work.** For the purpose of this clause, month of execution of erection work shall mean the schedule month of execution of the erection work or actual month of execution of the erection work, whichever is earlier. The schedule date for completion of a particular erection activity shall be as identified in line with provisions of Time schedule, Appendix-4 to the Contract Agreement.

The above formula for foreign exchange portion of Installation Component of

Contract Price shall be applicable if the currency in which the contract price has been expressed is different from the currency of country of origin of indices for foreign labour. In other cases, the formula shall be applied without

exchange rate correction factor 'f'.

In case of erection activities which are delayed beyond the schedule date for reasons attributable to the contractor, the price adjustment provision shall not be applicable for the period of time between the schedule date of completion and actual date of completion of the respective erection activity. For this purpose, the schedule date for completion of a particular erection activity shall be as **identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.**

(ix) Site Fabricated Structural Works Price Component

It is understood that the Structural Works Price Component comprises a fixed portion (designated as 'F' and the value of which is specified hereunder) and variable portion linked with the indices for various materials and labour (description and coefficients as enumerated below).

The amount of price adjustment towards variable portion payable/recoverable shall be computed as follows :

$$ESW = ESW1 - ESWo$$

ESW1 will be computed as follows :

$$ESW1 = ESWo \left\{ F + a \times \frac{A_1}{A_o} + b \times \frac{B_1}{B_o} + 0.5 \times L_b \times \frac{L_1}{L_o} + 0.5 \times L_b \times \frac{W_1}{W_o} \right\}$$

Where,

ESW = Adjustment to Structural Works Price Component expressed in the currency of the Contract.

ESW1 = Adjusted amount of Structural Works Price Component expressed in the currency of the Contract.

For the purpose of computing ESWo, each structural bill (which is excluding advance and amount payable on successful completion of **Trial/Initial Operation** and on successful Completion of the Guarantee Tests) during the structural work period upto the completion of the facilities' shall be divided by a factor as indicated below :

Structural Component of the contract price	-	{ Advance amount + structural component of the contract price payable on successful completion of Trial/Initial Operation and on successful Completion of the Guarantee Tests }
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Structural Component of the Contract Price

The payment of price adjustment amount so computed (refer S.No. H, Appendix-1) shall be made against a separate invoice, linking the corresponding invoice for Structural Work Portion of Installation payment after retaining the pro-rata amount due on successful completion of **Trial/Initial Operation** and on Completion of the Guarantee Tests. The amount so retained shall be paid on successful completion of Initial Operation and on Completion of the Guarantee Tests respectively.

F = The fixed portion of the Structural Works Price Component shall be 0.20.

- a, b shall be co-efficient of major materials/items involved in the Structural Works Price Component of the Contract Price.

- A, B shall be published price indices of corresponding major material/items.
- "Lb" shall be co-efficient for labour component for Structural Works Price Component of Contract Price which shall be 0.15.
- **L shall be one of the labour indices, namely, Consumer Price Index for Industrial Workers (Gen.) applicable to "All India" as published by Labour Bureau, Shimla of the Govt. of India.**
- **W shall be the other labour index, which is the Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher**
- - Sum of all the material co-efficient and the labour coefficient shall be 0.80.

Subscript '0' refers to indices as on 7 days prior to to deadline for submission of bids.

subscript '1' refers to the indices/ minimum wages as applicable for one month prior to the month of execution of the structural work.

In case there is a revision in the applicable minimum wages during a month, calculation of 'W₁' would take into consideration the weighted average of the applicable wages (wage before revision and wage after revision) and the number of days of applicability of such wages in the month.

For the purpose of this clause, month of execution of structural work shall mean the schedule month of execution of the structural work or actual month of execution of Structural Work, whichever is earlier. The schedule date for completion shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

In case of Structural Works activities which are delayed beyond the schedule date for reasons attributable to the contractor, the price adjustment provision shall not be applicable for the period of time between the schedule date of completion and actual date of completion of the respective Structural activity. For this purpose, the schedule date for completion of a particular Structural activity shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

(x) Price adjustment for civil works component of the Contract Price [including construction materials and excluding Demolition of existing structures (if applicable) price]

The prices quoted by the bidder shall be base price, which will be subjected to price adjustment in accordance with the conditions and formula prescribed herein and further subject to satisfying the requirement specified in this clause.

A fixed percentage of the civil works component of the contract price shall be firm and shall not be subject to any price adjustment. The balance portion of the civil works component of the contract price shall be subject to price adjustment on account of changes in materials and labour as detailed below :

$$CV = CV1 - CVo$$

CV1 will be computed as follows :

$$CV1 = CVo (F + m \times \frac{M_1}{M_0} + d \times \frac{D_1}{D_0} + s \times \frac{S_1}{S_0} + c \times \frac{C_1}{C_0} + 0.5 \times Lb \times \frac{L_1}{L_0} + 0.5 \times Lb \times \frac{W_1}{W_0})$$

Where,

CV = Adjustment to civil works component expressed in the currency of the contract payable to the contractor for each billing period.

CV1 = Adjusted amount of Civil Works Price Component of contract price i.e. value of work done after application of above price adjustment formula in the billing period.

CVo = Base Value of Civil Works Price Component of contract price, i.e. the value of the Civil work done in the billing period as per the monthly billing schedule for which the price adjustment is to be calculated.

CVo shall be calculated as under:

Each Civil Works bill (which is excluding advance and amount payable on successful completion of **Trial/Initial Operation** and on successful Completion of the Guarantee Tests) during the Civil Works period upto the 'completion of the facilities' shall be divided by a factor as indicated below :

Civil Works Component of the contract price - { Advance amount + Civil Works component of the contract price payable on successful completion of **Trial/Initial Operation** + Civil Works Component of the Contract Price payable on successful completion of Guarantee Tests}

Civil Works Component of the Contract Price

The payment of price adjustment amount so computed (refer S.No. H, Appendix-1) shall be made against a separate invoice, linking the corresponding invoice for Civil Works Portion of Installation payment after retaining the pro-rata amount due on successful completion of **Trial/Initial Operation** and on Completion of the Guarantee Tests. The amount so retained shall be paid on successful completion of Initial Operation and on Completion of the Guarantee Tests.

F = Fixed portion of the contract price which will not be subjected to any adjustment under this formula or otherwise which will be 0.20.

m = Coefficient of material (excluding cement & steel) content in the cost of civil portion of the work which will be 0.15.

d = Coefficient of High Speed Diesel Oil (P.O.L) content in the cost of civil portion of the work which will be 0.05.

- s = Coefficient of steel content in the cost of civil portion of work which will be 0.25.
- c = Coefficient of cement content in the cost of civil portion of work which will be 0.10.
- Lb = Coefficient of labour (for all categories) content in the cost of civil portion of the work which will be 0.25.
- M = Material Index, namely, Index No. of wholesale price under group. "All commodities" as published by office of the Economic Adviser, Government of India.
- D = High Speed Diesel Oil price, namely price of High Speed diesel oil, at Pump Station of India Oil Corporation nearest to the project site. (selling price inclusive of taxes and duties as per litre of H.S.D. Oil).
- S = Index for steel content shall be "Mild Steel-Long Products"/ "Mild Steel-Flat Products" as published by Ministry of Commerce and Industry, GOI.
- C = Index for "Pozzolana Cement " as published by Ministry of Commerce and Industry, GOI.
- L = **Labour Indices, namely, Consumer Price Index for Industrial Workers (Gen.) applicable to "All India" as published by Labour Bureau. Shimla of the Govt. of India.**
- W = **Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher**

Subscript

- 'o' = Refers, to the values of above mentioned minimum wages, labour, material, steel and cement indices, and for diesel price as on 7 days prior to Deadline set for submission of bids.
- '1' = Refers to values of corresponding minimum wages, labour, material, steel and cement indices, and for diesel price as applicable for one month prior to month in which the Civil work is executed.

In case there is a revision in the applicable minimum wages during a month, calculation of 'W₁' would take into consideration the weighted average of the applicable wages (wage before revision and wage after revision) and the number of days of applicability of such wages in the month.

For the purpose of this clause, month of execution of civil work shall mean the schedule month of execution of Civil work or actual month of execution of Civil Work, whichever is earlier. The schedule date for completion shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

In case of Civil Works activities which are delayed beyond the schedule date for reasons attributable to the contractor, the price adjustment provision shall not be applicable for the period of time between the schedule date of completion and actual date of completion of the respective Civil Work activity. For this purpose, the schedule date for completion of a particular Civil Work activity shall be as identified in line with provisions of Time Schedule, Appendix-4 to the Contract Agreement.

- (xi) The following components of the contract price shall not be subject to price adjustment and shall remain firm during the execution of the contract :

- (1) Ocean Freight and Marine Insurance for Plant and Equipment, mandatory spares and recommended spares.
 - (2) Inland Transportation charges (including Inland Transit Insurance, port clearance, port handling & port charges) for plant & equipment and Spare Parts.
 - (3) Type Test Charges (if any)
 - (4) Training Charges (if any)
 - (5) Annual Maintenance Contract (AMC) Charges (if any).
 - (6) Demolition of existing structures component of Contract Price (if applicable)
- (xii) The value of co-efficients and the source of applicable indices and their base values for the purpose of computing price adjustment under the contract shall be as under:

A. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Steam Generator Systems excl. Factory Fabricated Structures, Electrical Systems & C&I System as specified in Technical Specification and in coherence to Price Schedule)*

S.No.	Item	Value of Coefficient	Name of published index and its origin	Value of Base Date Indices (as on 30 days prior to deadline set for submission of Techno-commercial bids.)
Fixed Portion		F=0.15		
Material :				
1.		a =		
2.		b =		
3.		c =		
			
			
4.	Labour :	Lb =		

B. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Steam Turbine Generator Systems excl. Factory Fabricated Structures, Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)*

S.No.	Item	Value of Coefficient	Name of published index and its origin	Value of Base Date Indices (as on 30 days prior to deadline set for submission of Techno-commercial bids)

Fixed Portion F=0.15
Material :

1. a =
2. b =
3. c =
.....
4. Labour : Lb =

C. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Balance of Plant Systems excl. Factory Fabricated Structures, Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)*

S.No.	Item	Value of Coefficient	Name of published index and its origin	Value of Base Date Indices (as on 30 days prior to deadline set for submission of Techno-commercial bids)
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Fixed Portion F=0.15
Material :

1. a =
2. b =
3. c =
.....
4. Labour : Lb =

D. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Electrical Systems and C&I System as specified in Technical Specification and in coherence to Price Schedule)*

S.No.	Item	Value of Coefficient	Name of published index and its origin	Value of Base Date Indices (as on 30 days prior to deadline set for submission of Techno-commercial bids)
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Fixed Portion F=0.15
Material :

1. a =
2. b =
3. c =
.....
.....
4. Labour : Lb =

E. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Factory Fabricated Structures as specified in Technical Specification and in coherence to Price Schedule)*

S.No.	Item	Value of Coefficient	Name of published index and its origin ^{\$}	Value of Base Date Indices (as on 30 days prior to deadline set for submission of Techno-commercial bids)
Fixed Portion F=0.15				
Material :				
a)	Hot Rolled Coils & Sheets	(a) 0.45	Index for "Hot Rolled (HR) Coils & Sheets, including Narrow Strip" under sub-group of "Mild Steel -Flat Products" under Group of "Manufacture of Basic Metals" as published by Ministry of Commerce and Industry, GOI	
b)	Manufacture of fabricated Metal Products-Structural Metal Product	(b) 0.15	Index for "Manufacture of structural metal products" under Group of "Manufacture of Fabricated metal products, except Machinery and Equipment" as published by Ministry of Commerce and Industry, GOI	
Labour :				
		Lb = 0.25	Consumer price index for industrial workers (All India General) as published by Labour Bureau, Shimla.	

^{\$}Specified source of indices is for Ex-Works Price Component only. Bidder to furnish the same for FOB Price Component.

F. Ex-Works/FOB Price Component of Plant and Equipments including spares, but excluding Type Tests Charges (Any other Items not covered in A to E above, in coherence to Price Schedule)*

S.No.	Item	Value of Coefficient	Name of published index and its origin	Value of Base Date Indices (as on 30 days prior to deadline set for submission of Techno-commercial bids)
Fixed Portion F=0.15				
Material :				
5.		a =		
6.		b =		

7.

C =
.....

8. Labour : Lb =

G. Installation Price Component*

S.No.	Item	Value of Coefficient	Name of published index and its origin	Value of Base Date Indices as on 30 days prior to deadline set for submission of Techno-commercial bids
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Fixed Portion F = 0.15

Indian Field Labour

- | | | | | |
|------|--|------------|---|--|
| (i) | | 0.5 x 0.85 | All India Consumer Price index for industrial workers (All Indian Monthly Average) published by Labour Bureau, Simla, Govt. of India | |
| (ii) | | 0.5 x 0.85 | Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher | |

Expatriate Labour (EF) 0.85

H. Civil Works Price Component*

Item	Index	Value of Coefficients	Name of published index and its origin	Value of Base date Indices as on 7 days prior to deadline set for submission of Techno-commercial Bids
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Fixed Portion F = 0.20

1. Labour

(i) **0.5 x Lb = 0.5 x 0.25** Consumer price index for industrial workers (All India General) as

published by Labour Bureau, Shimla.

(ii) $0.5 \times L_b = 0.5 \times 0.25$ **Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher**

- | | | |
|----|---|--|
| 2. | Material m = 0.15
(excluding cement & steel) | Index no. of wholesale Price under group "All Commodities" as published by Ministry of Commerce and Industry, GOI |
| 3. | High Speed Diesel d = 0.05 | Price of high speed diesel oil per litre at the Indian Oil Corpn. outlet nearest to the project (selling price inclusive of taxes & duties, if any) |
| 4. | Steel s = 0.25 | Index for steel content shall be " Mild Steel -Long Products / "Mild Steel-Flat Products" as published by Ministry of Commerce and Industry, GOI. |
| 5. | Cement c = 0.10 | Index for " Pozzolana Cement " as published by Ministry of Commerce and Industry, GOI. |

I. Site Fabricated Structural Works Price Component*

Item	Coefficient	Value of Coefficients	Name of published index and its origin	Value of Base Indices (as on 7 days prior to deadline set for submission of Techno-commercial Bids)
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Material :

a)	Hot Rolled Coils & Sheets	(a)	0.50	Index for "Hot Rolled (HR) Coils & Sheets, including Narrow Strip" under sub-group of "Mild Steel -Flat Products" under Group of "Manufacture of Basic Metals" as published by Ministry of Commerce and Industry, GOI
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b)	Manufacture of fabricated Metal Products-Structural Metal Product	(b)	0.15	Index for "Manufacture of structural metal products" under Group of "Manufacture of Fabricated metal products,
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c) Labour :

(i) $0.5 \times I = 0.5 \times 0.15$ Consumer price index for industrial workers (All India General) as published by Labour Bureau, Shimla.

(ii) $0.5 \times I = 0.5 \times 0.15$ **Arithmetical average of Minimum Wages for Unskilled, Skilled, Semi-skilled and Highly skilled workers notified by the Central Government for the particular classified Area in which the project site is located or notified by the State Government of the state in which the project site is located, whichever is higher**

d) Fixed Component : F_s 0.20

* The above information shall be filled in at the time of Contract Agreement signing based on price adjustment data offered by the bidder in Attachment-5(P) to Bid Form of Techno-Commercial Bids and/or as mutually discussed and agreed upon.

Note: Bidder is required to necessarily quote the indices w.r.t. price adjustment for each component of price schedules for which the price break-up has been asked for/furnished such as SG System, STG System, BOP Systems, Electrical and C&I System and Factory Fabricated Structures.

INSURANCE REQUIREMENTS

(1) Insurance to be taken by the Contractor:

In accordance with the provisions of GCC Clause 34, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintain in effect, during the performance of the Contract, the insurances set forth below in sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

Insurance	Amount insured	Deductible	Conditions
A. Marine Cargo	(i) 110% of CIF Value in case of Plant and Equipments including all spare parts and Type Tests Charges to be supplied from abroad and/or 110% of Ex-Works Value in case of Plant & Equipments and Type Tests Charges including all spare parts manufactured within the Employer's Country. (ii) Applicable Taxes and Duties (iii) Escalation 5% on (i) & (ii)	Not applicable	(i) Employer to be named as coinsured (ii) Open Policy (iii) All Risk Institute Cargo Clause 'A' (iv) War, SRCC, Terrorism. (v) Institute Replacement Clause Special Replacement Clause (Air Duty) and Deferred Unpacking Clause (vi) Insurers right of subrogation against all parties (excluding carrier) waived. (vii) Warehouse to Warehouse basis.
B. Installation all Risk	(i) 110% of CIF Value plus 110% of Ex-Works Value of Plant & Equipments (ii) Applicable Taxes and Duties (iii) Cost of indigenous Procurement and Free Issue Materials (iv) 10% Escalation on (i) (ii) & (iii) (v) Cost of Erection Works	Minimum as per Insurance Policy	(i) Installation Risk, RSMTD, (ii) Air Freight Cover. (iii) Extra Charge Cover. (iv) Maintenance Cover (v) Contractor's Plant & Machinery - Rs. 100 Lakhs (vi) Cross Liability. (vii) Additional Customs Duty for Imported Machine (if any) for adequate value. (viii) Employer & Contractor's Sub-Contractor to be named as co-insured.
C. Third Party Liability (Extension of MCE/EAR Policy)	For any one occurrence Rs. 50.00 Lakhs	Nil	(i) Contractors, sub-contractors to be named as co-insured.

Insurance	Amount insured	Deductible	Conditions
D. Automobile Liability			
(i) M.V. Policy for Motor Vehicles, Private Cars & Commercial Vehicles		-----	As per local M.V. Act.
(ii) CPM Policy for Heavy Construction Equipment	Anything above Rs.100 Lakhs covered under Erection all Risk Policy		
E. Workmen's Compensation	_____	As per statute _____	
F. Employer's Liability	_____	As per statute _____	Cumulative to workmen's compensation to cover liability not covered thereby.
G. Group Personal Insurance, for Contractor's & Sub-contractor's Employees			

Note :

- The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC 34.1 except for Third Party Liability, Workman's Compensation and Employer's Liability Insurances and the Contractor's Sub-Contractors shall be named as co-insured under all insurances policies taken out by the Contractor pursuant to GCC 34.1, except for the Cargo Insurance during Transport, Workman's Compensation and Employer's Liability Insurances. All insurers rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.**
- Notwithstanding the insurance requirements mentioned above, it would be the Contractor's responsibility to take adequate insurance cover as may be pertinent to protect his interest and interest of the Employer. If at any point of time during execution of the Contract, the insurance policies are found to be inadequate, the Contractor shall take fresh insurance policies meeting aforesaid requirements. The Employer reserves the right to make suitable recovery from the Contractor, if any.
- Any loss or damage to the plant and equipments during handling, transportation, storage, installation, commissioning, and all activities to be performed till the "Completion of Facilities" shall be to the account of the contractor. The contractor shall be responsible for preference of all claims and make good the damages or loss by way of repairs and/or replacement of plant and equipments damaged or lost. Notwithstanding the extent of insurances cover and the amount of claim available from the underwriter, the contractor

shall be liable to make good the full replacement/rectification of all the equipments/materials and to ensure their availability as per project requirement without additional financial liability to the Employer.

The insurance should be in freely convertible currency and insurance policy to be taken should be on replacement value basis and/or incorporating appropriate insurance clause.

The Contractor shall follow local acts and laws as may be prevalent for insurance.

4. Upon grant of extension of time for completion by Employer, the contractor shall promptly furnish documentary evidence to project Manager towards extension of insurance policies for the period of extension.

II) Insurances to be taken by the Employer.

The Employer shall take the insurance for its own employees, its stores and its machinery.

TIME SCHEDULE

- 1.0 It is clearly understood and agreed that time is the essence of this Contract and shall be strictly adhered to by the Contractor. The program of furnishing, erecting, testing, commissioning and completion of facilities identifying the key phases in various areas of work like design, procurement, manufacture, field activities shall be as per detailed PERT Network enclosed as Annexure-I (the detailed PERT Network submitted by the Bidder as per item no. 10 of Bid Data Sheet and as mutually discussed and agreed before Notification of Award shall be enclosed as Annexure-I to this Appendix-4). As per this detailed PERT Network, the key milestones for completion of facilities are asunder:

Sl. No.	Description of Area/ Major Milestones	Duration in months from NOA	
		Start	Finish
1.	Basic Engineering	00	04
2.	Detailed Engineering	-	09
3.	Completion of Ordering of BOIs (Bought out Items)	-	06
4.	Commencement of Manufacturing	05	-
5.	Supply of Materials	08	20
6.	Establishment of Site Office, Storage Facilities & Mobilisation	-	06
7.	Equipment Erection Works* (Mechanical, Electrical, C&I)	09	24
8.	Progressive Commissioning of Gas Engine Modules	24	26
9.	Completion of Facilities	-	28
10.	Supply of Mandatory Spares	-	22

Note:

1. "Start" in each activity means next day after the lapse of duration given from NOA, however, in case of "Start=0" the start date will be the date of NOA.
2. "Finish" means last day of completion of the period of particular activity.

- 2.0 This master network and the key milestone dates will be discussed and agreed before the execution of Notification of Award. Engineering Drawing and Data Submission Schedule shall also be discussed and finalized before the issue of Notification of Award.
- 3.0 After the Notification of Award, the contractor shall plan the sequence of work of manufacture and erection to meet the above stated dates of successful completion of facilities and shall ensure all work, manufacture, shop testing, inspection and shipment of the equipment in accordance with the required construction/erection sequence.
- 4.0 Within one month of the Notification of Award, the Contractor shall submit to the Employer for his review and approval two copies (one reproducible and one print) of detailed PERT Network schedules with master network activities further exploded based on the Master Network mutually agreed by the employer and contractor, showing the logic and duration of the activities covered in both the First and Second Contracts in the following areas: Engineering, procurement, manufacturing and supply, detailed engineering, procurement (including brought out items), manufacturing, dispatch, shipment, receipt at site and activities related to erection, commissioning and completion of facilities.

5.0 Detailed Manufacturing Programme

Detailed Manufacturing PERT Network for all the manufacturing activities and Contractor/sub-Contractors works shall also be furnished within 60 days of Notification of award. The manufacturing network shall be supported by detailed procurement programme for critical bought out item/raw materials.

6.0 Pre-Erection Activity Programme

The erection network will be supported by detailed Pre-erection activity programme covering the following:

- A) Manpower Deployment
- B) T&P Mobilization
- C) Detailed Site Mobilization Plant

- 6.1 The bidder shall furnish the list of T&P to be deployed by him in Attachment-11 along with the Methodology of Construction and Erection which shall be discussed and mutually agreed to before Notification of the Award along with the schedule of deployment of such T&P.

The finalized list of T&P along with the schedule of their deployment shall then be enclosed as Annexure-4B to Appendix-4 of the Contract Agreement.

Any additional T&P required for satisfactory execution of the Contract as per specified time schedule, shall be mobilized by the Contractor as per the directions of Project Manager without any extra cost to Employer.

- 7.0 Within one week of approval of the network schedule, the Contractor shall forward to the Project Manager, copies of the Computer Initial run-Data. The type of outputs and number of copies of each type to be supplied by the Contractor shall be determined by the Project Manager.
- 8.0 All the networks shall be updated every month or at a frequency mutually agreed upon. Within seven days following the Monthly Review, a progress meeting shall be held, whenever possible at the works, wherein the major items of the plant or equipment are being produced. The meeting will be attended by the Project Manager and responsible representative of Contractor that the Project Manager consider necessary for the meeting.
- 9.0 Access to the Contractor's and Sub-Contractor's work shall be granted to the Project Manager at all reasonable times for the purpose of ascertaining the progress.

APPENDIX - 4A TO APPENDIX - 4

MASTER NETWORK

[The Master Network as per para 1.0 of Appendix-4 shall be enclosed here as Appendix-4A to appendix-4]

LIST OF MINIMUM T&P AND SAFETY EQUIPMENTS & SAFETY PERSONAL PROTECTIVE EQUIPMENTS TO BE DEPLOYED BY THE CONTRACTOR

(i) Major T&Ps

A list of minimum No. of Major T&P required to be deployed necessarily by the bidder is furnished below. However, the actual deployment at site shall not be limited to these and additional T&P required to meet the work schedule shall be mobilized by the Contractor.

Sl. No.	Name & Type of Major T&P	Min. No. to be deployed	Period of Retention	
			from (months from NOA)	to (months from NOA)

The list of T&P along with the Schedule is to be duly filled up by the Bidder to ensure smooth execution of the works at site as per scope of the Contract.

(The list of T&P along with the schedule of their deployment, as finalized before Notification of Award shall be enclosed here as Appendix-4B to Appendix-4).

(ii) Safety Equipment's & Safety Personal Protective Equipment's

A list of minimum suggestive Safety Equipment's & Safety Personal Protective Equipment's to be deployed necessarily by the bidder is furnished below. However, the actual deployment at site shall not be limited to these and additional equipment if required shall be mobilized by the Contractor.

Sl. No.	Minimum Suggested List of Safety Equipment's and Safety Personal Protective Equipment's	Minimum Quantity
1.	<p>Safety Net (Conforming IS 11057:1984)</p> <p>Safety Net (Net Size: 10m x 5m, Mesh Size: 25 mm, Mesh Rope: 2mm double cord, Border/Tie Cord: 12mm diameter polypropylene rope (tested as per IS: 5175).Two meters length shall be provided at all four corners.</p>	25 Nos.
2.	<p>Fall Arrester 'Rope grab fall arrester' & anchorage line.</p> <p>Anchorage Line: 14mm- 16 mm diameter, three strand twisted Polyamide rope.</p> <p>Rope Grab fall arrester: Openable & Guided type Fall Arrestor (on flexible line) conforming EN 353-2 & works on 14-16 mm diameter polyamide rope. material: Nickel Chrome plated Steel Connector: Karbiner conforming to EN 362 (Minimum Strength 22 KN), material: Steel</p>	<p>30 Nos. of „Rope Grab Fall arrester“ and Karbiner each.</p> <p>10 Nos. of anchorage line, each 30 meter long.</p>
3.	<p>Horizontal life line</p> <p>Stainless Steel Wire rope of 8mm diameter. Minimum six nos. of steel U-bolt clips are required for clamping each wire rope to a rigid support (03 nos. of U-bolt clips at each end).</p>	20 Nos. of wire rope, each 40 meter long.
4.	<p>Ladders on column</p> <p>The minimum design live load on metallic ladder shall be a single concentrated load of 100 kilo grams. All rungs shall have a minimum diameter of 1.90 centimeters, and minimum clear length of rungs shall be 40.6 centimeters. The distance between rungs shall not exceed 30.5 centimeters. Each ladder shall have maximum height of 9.0 meter.</p> <p>The ladder shall have proper fastenings for attaching it to a column using positive means such as bolt, weld or other type of fasteners.</p>	cumulative length of ladders is 100 meters

5.	Safety PPEs (Industrial Safety helmet & Industrial Safety Shoes) Industrial Safety Helmet (IS:2925-1984 marked). Industrial Safety/Electrical Shoes (IS:15298-2002 marked). Full body Safety Harness (conforming IS:3521)	100nos. 100nos. 30 nos.
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LIST OF SUB-CONTRACTORS

PART 1. Nominated Sub-Contractors

In the event that the employer wishes to nominate any particular Sub-Contractors for the undertaking of any part or parts of the Works, these shall be identified and named by the Employer in the following schedule prior to the issue of the Bidding Documents.

Full details shall be given of the part of the Works to be executed, and the names and addresses of the Sub-Contractors to whom the part of the Works is to be sub- contracted by the Bidder. Where more than one name is given for any part of the Work, the Bidder shall be free to select any of the named Sub-Contractors for that part.

Item of Work	Nominated Sub-Contractor
	NIL

PART2 Approved Sub-Contractors

(Prior to award of Contract the following details shall be completed indicating those Sub-contractors proposed by the Bidder by Attachment to his Bid which are approved by the Employer for engagement by the Contractor during the performance of the Works).

The following Sub-Contractors are approved for carrying out the item of work indicated. Where more than one Sub-contractor is listed, the Contractor is free to choose between them but he must notify the Employer of his choice in good time prior to appointing any selected Sub-Contractor. In accordance with Clause GCC 19.1, the Contractor is free to submit proposals for additional Sub-Contractors from time to time. No Sub-Contracts shall be placed with any such additional Sub- Contractors until they have been approved in writing by the Employer and their names added to this list of Approved Sub-Contractors.

Sl. No.	Item of Work	Approved Sub-Contractors	Nationality
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LIST OF DOCUMENTS FOR REVIEW AND APPROVAL
(To be finalized during post bid discussion stage)

A. Approval

- 1.
- 2.
- 3.

B. Review

- 1.
- 2.
- 3.

Note : This list of documents required for approval/review by the Employer shall be as per Attachment 12 to Bid Form, Section VII of bidding document and as finalized during the Post Bid Discussion stage.

FUNCTIONAL GUARANTEES

The Functional Guarantee shall be as per the Provisions of Technical Specifications. The contents of this Appendix shall however be finalized at the time of Award of Contract.

6. PERFORMANCE SECURITY FORM

6. Performance Security Form

(To be stamped in accordance with Stamp Act if any, of the Country of the Issuing Bank)

To,
[Employer's Name & Address]

Bank Guarantee No.....
Date.....

Dear Sirs,

In consideration of the [Employer's Name].....(Hereinafter referred to as the „Employer“ which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) having awarded to M/s..... [Contractor's Name]..... with its Registered /Head Office at (hereinafter referred to as the „Contractor“, which expression shall unless repugnant to the context or meaning thereof, include its successors administrators, executors and assigns), a Contract by issue of Employer's Notification of Award No.datedand the same having been Unequivocally accepted by the contractor, resulting into a Contract bearing No. dated valued at for and the Contractor having agreed to provide a Contract Performance Guarantee for the faithful performance of the entire Contract equivalent to(*).....% (percent) of the said value of the Contract to the Employer.

We[Name & Address of the Bank].....having its Head Office at(hereinafter referred to as the „Bank“, which expressions shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, on demand any and all monies payable by the Contractor to the extent of(*)..... as aforesaid at any time upto(@)..... [days/month/year] without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.

The Employer shall have the fullest liberty, without affecting in any way the liability of the Bank under this guarantee, from time to time to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would, but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contained hereinabove our liability under this guarantee is restricted to(*)..... and it shall remain in force up to and including(@)..... and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s[Contractor's Name]..... on whose behalf this guarantee has been

given.

Dated this day of 20..... at.....

WITNESS :

1. (Signature)	..... (Signature)
..... (Name)	..... (Name)
..... (Official Address)	..... (Designation with Bank Stamp)

Authorized Vide Power of
Attorney No.....

Date.....

2.
(Signature)

.....
(Name)

.....
(Official Address)

- Notes :**
1. (*) This sum shall be ten percent (10%) of the Contract Price.
 - (@) This date will be ninety (90) days beyond the the Defects liability period as specified in the Contract.
 2. The stamp papers of appropriate value shall be purchased in the name of guarantee issuing Bank or the Party on whose behalf for BG is being issued. The Bank Guarantee shall be issued on a stamp paper of value as applicable in the State of India from where Bank Guarantee is issued or the State of U.P. or the State of India from where the BG shall be operated, **whichever is higher.**
 3. While getting the Bank Guarantee issued, the Contractor is required to ensure compliance to the points mentioned in Form 16B- Form of Bank Guarantee Verification Check List. Further, the Contractor is required to fill up this Form 16 and enclose the same with the Bank Guarantee.
 4. The Bank Guarantee shall be from a Bank as per provisions of Section-V (SCC) of the Bidding Documents.

6a. Performance Security Form

(In case of Contract awarded to Joint Venture)

NOT APPLICABLE

Note : In case of Contract awarded to Joint Venture wherever [Contractor's Name] is appearing, name of both the partners will be mentioned with the name of place of Registered/Head Office wherever applicable.

7. BANK GUARANTEE FORM FOR ADVANCE PAYMENT (SUPPLY EX-WORKS)

**7(i). Bank Guarantee Form for Advance
Payment (Supply-FOB/ Ex-Works)**

(To be stamped in accordance with Stamp Act if
any, of the Country of the Issuing Bank)

Bank Guarantee No.....
Date.....

To,
[Employer's Name & Address]

Dear Sir,

In consideration of[Employer's Name].....
 (hereinafter referred to as the „Employer“, which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s.....[Contractor's Name]..... with its Registered/Head Office at.....
 (hereinafter referred to as the „Contractor“ which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a Contract, by issue of Employer's Notification of Award No. dated and the same having been unequivocally accepted by the Contractor, resulting into a Contract bearing No.
 dated..... valued at
 for [Name of Contract]
(hereinafter called the „Contract“) and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting
 (in words and figures) as an Advance against Bank Guarantee to be furnished by the Contractor.

We.....[Name and address of the Bank]..... having its Head Office at
 (Hereinafter referred to as the „Bank“, which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the Contractor to the extent of.....[advance amount].....
 as aforesaid at any time up to(@)..... without any demur, reservation, contest, recourse or protest and/ or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Not with standing anything contained herein above our liability under this guarantees limit to[advance amount]..... and it shall remain in force up to and including(@)..... and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s.....[Contractor's Name]..... on whose behalf this guarantee has been given.

Dated this day of 20 at

WITNESS :

1.
 (Signature) (Signature)
 (Name) (Name)
 (Official Address) (Designation with
 Bank Stamp)
 Authorized Vide Power of
 Attorney No.....
 Date.....

2.
 (Signature)
 (Name)
 (Official Address)

- NOTE:
1. (@) This date shall be ninety (90) days beyond the date of Completion of the Facilities.
 2. The Bank Guarantee shall be from a Bank as per provisions of Section-V (SCC) of the Bidding Documents.
 3. The Stamp Paper of appropriate value shall be purchased in the name of guarantee issuing Bank.

 The Bank Guarantee shall be issued on a stamp paper of value as applicable in the State of the issuing bank in India or the State of Delhi in India or the State of India from where the BG shall be operated, whichever is higher.
 4. While getting the Bank Guarantee issued, Bidders are required to ensure compliance to the points mentioned in Form 16-Form of Bank Guarantee Verification Check List. Further, the Contractor is required to fill up this Form 16 and enclose the same with the Bank Guarantee.

**7(ii). Bank Guarantee Form for Advance Payment
(Installation Services)**

(To be stamped in accordance with Stamp Act if
any, of the Country of the Issuing Bank)

Bank Guarantee No.....
Date.....

To,
[Employer's Name & Address]

Dear Sir,

In consideration of[Employer's Name].....
 (hereinafter referred to as the „Employer“, which expression shall, unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to M/s.....[Contractor's Name]..... with its Registered/Head Office at.....
 (hereinafter referred to as the „Contractor“ which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns), a Contract, by issue of Employer's Notification of Award No. dated and the same having been unequivocally accepted by the Contractor, resulting into a Contract bearing No.
 dated..... valued at
 for[Name of Contract]
(hereinafter called the „Contract“) and the Employer having agreed to make an advance payment to the Contractor for performance of the above Contract amounting
 (in words and figures) as an Advance against Bank Guarantee to be furnished by the Contractor.

We.....[Name and address of the Bank]..... having its Head Office at(hereinafter referred to as the „Bank“, which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or, all monies payable by the Contractor to the extent of[110% of advance amount]..... as aforesaid along with interest **"SBI 1-year MCLR as on 01st April of applicable year + 150 bps"** per annum on the advance amount released by the Employer calculated from the date of release of the said advance by the Employer to the Contractor, at any time up to(#)..... without any demur, reservation, contest, recourse or protest and/ or without any reference to the Contractor. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.

The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Employer and the Contractor or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or

thing whatsoever which under law would but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Not with standing anything contained herein above our liability under this guarantee is limited to[110% of advance amount]along with interest therein as aforesaid and its shall remain in force up to and including.....(@).....and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s.....[Contractor's Name]..... on whose behalf this guarantee has been given.

Dated this day of 20 at

WITNESS :

1.
 (Signature)

.....
 (Name)

.....
 (Official Address)

.....
 (Name)

.....
 (Designation with Bank Stamp)

Authorized Vide Power of Attorney No.....

Date.....

2.
 (Signature)

.....
 (Name)

.....
 (Official Address)

Notes:

1. (#) This date shall be ninety (90) days beyond the date of Completion of the Facilities.
2. (**) The rate of interest shall be same as specified at S.No. E(II) in Appendix-I to Form of Contract Agreement (Terms of Payment).
3. The Bank Guarantee (BG) shall be from a Bank as per provisions of the Bidding Documents.
4. The BG should be on Non-judicial Stamp Paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the state where the BG is executed, whichever is higher. The Stamp Paper/e-Stamp paper shall be purchased in the name of Bidder/Bank issuing the guarantee.
5. While getting the Bank Guarantee issued, Bidders are required to ensure compliance to the points mentioned in Bank Guarantee Verification Check List in the Bidding Documents. Bidders are required to fill up this Check List and enclose the same along with the Bank Guarantee.

7(iii). Bank Guarantee Form for Advance Payment

(In case of Contract awarded to Joint Venture)

NOT APPLICABLE

In case of Contract awarded to Joint Venture wherever [Contractor's Name] is appearing, name of both the partners will be mentioned with the name of place of Registered/Head Office wherever applicable.

8. FORM OF COMPLETION CERTIFICATE

8. Form of Completion Certificate

Date : _____
Loan/Credit No: _____
IFB No: _____

[Name of Contract]

To: [Name and address of Contractor]

Dear Sirs,

Pursuant to GCC Clause 24 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated [date], relating to the [brief description of the facilities], we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof:[description]
2. Date of Completion:[date]

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities including Guarantee Test(s) in accordance with the Contract nor of your obligations during the Defects Liability Period.

Very truly yours,

Title
(Project Manager)

9. FORM OF OPERATIONAL ACCEPTANCE CERTIFICATE

9. Form of Operational Acceptance Certificate

Date: _____
Loan/Credit No: _____
IFBNo: _____

[Name of Contract]

To: [Name and address of Contractor]

Dear Sirs,

Pursuant to GCC Sub-Clause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated [date], relating to the [brief description of the facilities], we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof:[description]
2. Date of Operational Acceptance:[date]

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defects Liability Period.

Very truly yours,

Title
(Project Manager)

10. FORM OF TRUST RECEIPT

**10. FORM OF TRUST RECEIPT FOR PLANT,
EQUIPMENT AND MATERIALS RECEIVED**

We M/s *(Contractor's Name)*..... having our
Principal place of business athaving been awarded a Contract
No..... dated.....for *(Contract Name)*.....by
(Name of Employer)

We do hereby acknowledge the receipt of the Plant, Equipment and Materials as are fully described and mentioned under Documents of Title/RR/LR etc. and in the schedule annexed hereto, which shall form an integral part of this receipt as "Trustee" of*(Name of Employer)*. The aforesaid materials etc. so received by us shall be exclusively used in the successful performance of the aforesaid Contract and for no other purpose whatsoever. We undertake not to create any charge, lien or encumbrance over the aforesaid materials etc, in favor of any other person /institution(s)/Banks.

For M/s
(Contractor's Name)

Dated:.....

(AUTHORISED SIGNATORY)

11. FORM OF INDEMNITY-CUM-UNDERTAKING AGREEMENT

**11a. FORM OF INDEMNITY-CUM-UNDERTAKING AGREEMENT
FOR THE EQUIPMENTS
HANDLED OVER BY THE EMPLOYER
FOR PERFORMANCE OF CONTRACT
(Entire Equipment Consignment in one lot)**

(On Non-Judicial Stamp Paper of appropriate value)

INDEMNITY-CUM-UNDERTAKING AGREEMENT

THIS INDEMNITY-CUM-UNDERTAKING AGREEMENT is made this day of 20 between (Contractor's Name) a Company /Partnership Firm / Proprietary Concern incorporated under the laws of having its Registered Office at (hereinafter called as 'Contractor' which expression shall include its successors and permitted assigns) and (Name of Employer), a Company incorporated under the Indian Companies Act having its Registered Office at and its project at (Hereinafter called "....." / "Employer" which expression shall include its successors and assigns) :

WHEREAS the „Employer“ has awarded to the „Contractor“ a Contract forvide its Notification of Award/Contract No.....dated and its Amendment No. and Amendment No....., (*applicable when Amendments have been issued*)(hereinaftercalledthe"Contract")intermsofwhich.....@..... is required to hand over various Equipment's to the „Contractor“ for execution of the Contract.

And WHEREAS by virtue of Clause Noof the said Contract, the „Contractor“ and the „Employer“ are required to execute an Indemnity-cum-Undertaking Agreement for the Equipment's handed over to the „Contractor“ by@..... for the purpose of performance of the Contract/Erection Portion of the Contract (hereinafter called the "Equipment's")

AND THEREFORE, This Indemnity-cum-Undertaking Agreement witnesseth as follows:

1. That in consideration of various Equipment's as mentioned in the Contract, a list where of is also annexed to this Indemnity-cum-Undertaking Agreement at Schedule-A, valued at (Currency and amount in Figures)..... (Currency and amount in words) handed over to the „Contractor“ for the purpose of performance of the Contract, the „Contractor“ hereby undertakes to indemnify and shall keep the „Employer“ indemnified, for the full value of the Equipment's. The Contractor hereby acknowledges actual receipt of the Equipment's, etc. as per dispatch title documents handed over to the „Contractor“ as detailed in the Schedule appended hereto. The “Contractor” shall hold such Equipment's, etc. in trust as a "Trustee" for and on behalf of the “Employer”

@ Fill in abbreviated name of Employer.

2. That the „Contractor“ is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment's at@..... project site against all risks whatsoever till the Equipment's are duly used/erected in accordance with the terms of the Contract and the plant/package duly erected and commissioned in accordancewiththetermsoftheContractistakenoverbythe„Employer“The „Contractor“ undertakes to keep the „Employer“ harmless against any loss or damage that may be caused to the Equipment's.

3. The „Contractor“ undertakes that the Equipments shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the Equipment’s shall be utilised for any other work or purpose whatsoever. It is clearly understood by the „Contractor“ that non-observance of the obligations under this Indemnity-cum-Undertaking Agreement by the „Contractor“ shall inter-alia constitute a criminal breach of trust on the part of the „Contractor“ for all intents and purpose including legal/penal consequences.
4. That the „Employer“ is and shall remain the exclusive owner of the Equipment’s free from all encumbrances, charges or liens of any kind, whatsoever. The Equipment’s shall at all times be open to inspection and checking by the Project Manager or other employees / agents authorized by the „Employer“ in this regard. Further the „Employer“ shall always be free at all times to take possession of the Equipment’s in whatever form the Equipment’s may be, if in its opinion, the Equipment’s are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the „Contractor“ or any other person or on account of any reason whatsoever and the „Contractor“ binds himself and undertakes to comply with the directions of demand of the „Employer“ to return the Equipment’s without any demur or reservation.
5. That this Indemnity-cum-Undertaking Agreement is irrevocable. If at any time any loss or damage occurs to the Equipment’s or the same or any part thereof is misutilized in any manner whatsoever, then the „Contractor“ hereby agrees that the decision of the Project Manager of the „Employer“ as to assessment of loss or damage to the Equipment’s shall be final and binding on the „Contractor“. The „Contractor“ binds itself and undertakes to replace the lost and/or damaged Equipment’s at its own cost and/or shall pay the amount of loss to the „Employer“ without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to the „Employer“ against the „Contractor“ under the Contract and under this Indemnity-cum-Undertaking Agreement.
6. NOW THE CONDITION of this Indemnity-cum-Undertaking Agreement is that if the „Contractor“ shall duly and punctually comply with the terms and conditions of this Indemnity-cum-Undertaking Agreement to the satisfaction of the „Employer“, THEN, the above Indemnity-cum-Undertaking Agreement shall become void after the due performance of the Contract, but otherwise, it shall remain in full force and virtue.

@ Fill in abbreviated name of Employer.

IN WITNESS WHEREOF, the „Contractor“ and the „Employer“ have hereunto set their hand through their authorized representative, the day, month and year first above mentioned.

For and on behalf of

For and on behalf of

.....
(Contractor's Name)

.....
(Employer's name)

Signature.....
Name.....
Designation of.....
Authorised representative *

Signature.....
Name.....
Designation of.....
Authorised representative*

WITNESS:

WITNESS :

- 1. Signature.....
- 2. Name.....
- 3. Address.....

- 1. Signature.....
- 2. Name.....
- 3. Address.....

* Indemnity-cum-Undertaking Agreement are to be executed by the authorized person and (i) in case of contracting Company under common seal of the Company or (ii) having the Power of Attorney issued under common seal of the company with authority to execute Indemnity-cum-Undertaking Agreement , (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity-cum-Undertaking Agreement . In case of Employer, by the authorized representative of the Employer.

SCHEDULE - A

Particulars of the Equipments handed over	Quantity	Particulars of Despatch Title Documents	Value of the Equipments	Signature of Attorney in token of receipt
		RR/GR/Bill of Lading No & Date Carrier		

**11b. FORM OF INDEMNITY-CUM-UNDERTAKING AGREEMENT FOR THE EQUIPMENTS
HANDED OVER IN INSTALMENTS BY THE
EMPLOYER FOR PERFORMANCE OF CONTRACT**

(On Non-Judicial Stamp Paper of appropriate value)

INDEMNITY-CUM-UNDERTAKING AGREEMENT

THIS INDEMNITY-CUM-UNDERTAKING AGREEMENT is made thisday of..... 20 between(Contractor's Name) a Company /Partnership Firm / Proprietary Concern incorporated under the laws of having its Registered Office at (hereinafter called as 'Contractor' which expression shall include its successors and permitted assigns) and(Name of Employer), a Company incorporated under the Indian Companies Act having its Registered Office at and its project at (hereinafter called " " / „Employer“ which expression shall include its successors and assigns):

WHEREAS the „Employer“ has awarded to the „Contractor“ a Contract forvide its Notification of Award/Contract No.....dated andits Amendment No. and Amendment No., (*applicable when amendments have been issued*) (hereinafter called the "Contract") in terms of which.....@..... isrequiredtohandovervariousEquipmentstothe„Contractor“forexecution of the Contract.

And WHEREAS by virtue of ClauseNoof the said Contract, the „Contractor“and the „Employer“ are required to execute an Indemnity-cum-Undertaking Agreement for the Equipments handed over to the „Contractor“by.....@ for the purpose of performance of the Contract/Erection Portion of the Contract (hereinafter called the "Equipments")

NOW THEREFORE, This Indemnity-cum-Undertaking Agreement witnesseth as follows:

1. That in consideration of various Equipments as mentioned in the Contract, valued at (*Currency and amount in figures*)..... (*Currency and amount in words*) to be handed over to the „Contractor“ in instalments from time to time for the purpose of performance of the Contract, the „Contractor“ hereby undertakes to indemnify and shall keep the „Employer“ indemnified, for the full value of the Equipments. The Contractor hereby acknowledges actual receipt of the initial instalment of the Equipments, etc. as per details in the Schedule appended hereto. Further, the „Contractor“ agrees to acknowledge actual receipt of the subsequent instalments of the Equipments, etc. as required by@..... in the form of Schedules consecutively numbered which shall be attached to this Indemnity-cum-Undertaking Agreement so as to form integral parts of this Indemnity-cum-Undertaking Agreement. The „Contractor“ shall hold such Equipments, etc. in trust as a "Trustee" for and on behalf of the „Employer“.

@ Fill in abbreviated name of Employer.

2. That the „Contractor“ is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipments at@..... project site against all risks whatsoever till the Equipments are duly used/erected in accordance with the terms of the Contract and the plant/package duly erected and commissionedinaccordancewiththetermsoftheContract,istakenoverbythe „Employer“. The „Contractor“ undertakes to keep the „Employer“ harmless against any loss or damage that may be caused to the Equipments.

3. The „Contractor“ undertakes that the Equipment’s shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the Equipment’s shall be utilised for any other work or purpose whatsoever. It is clearly understood by the „Contractor“ that non-observance of the obligations under this Indemnity-cum-Undertaking Agreement by the „Contractor“ shall inter-alia constitute a criminal breach of trust on the part of the „Contractor“ for all intents and purpose including legal/penal consequences.
4. That the „Employer“ is and shall remain the exclusive owner of the Equipment’s free from all encumbrances, charges or liens of any kind, whatsoever. The Equipment’s shall at all times be open to inspection and checking by the Project Manager or other employees / agents authorized by the „Employer“ in this regard. Further, the „Employer“ shall always be free at all times to take possession of the Equipment’s in whatever form the Equipment’s may be, if in its opinion, the Equipment’s are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the „Contractor“ or any other person or on account of any reason whatsoever and the „Contractor“ binds himself and undertakes to comply with the directions of demand of the “Employer” to return the Equipment’s without any demur or reservation.
5. That this Indemnity-cum-Undertaking Agreement is irrevocable. If at any time any loss or damage occurs to the Equipment’s or the same or any part thereof is misutilised in any manner whatsoever, then the „Contractor“ hereby agrees that the decision of the Project Manager of the „Employer“ as to assessment of loss or damage to the Equipment’s shall be final and binding on the “Contractor”. The „Contractor“ binds itself and undertakes to replace the lost and/or damaged Equipment’s at its own cost and/or shall pay the amount of loss to the „Employer“ without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to the „Employer“ against the „Contractor“ under the Contract and under this Indemnity-cum-Undertaking Agreement.
6. NOW THE CONDITION of this Indemnity-cum-Undertaking Agreement is that if the „Contractor“ shall duly and punctually comply with the terms and conditions of this Indemnity-cum-Undertaking Agreement to the satisfaction of the „Employer“, THEN, the above Indemnity-cum-Undertaking Agreement shall become void after the due performance of the Contract, but otherwise, it shall remain in full force and virtue.

@ Fill in abbreviated name of Employer.

IN WITNESS WHEREOF, the „Contractor“ and the „Employer“ have hereunto set their hand through their authorized representative, the day, month and year first above mentioned.

For and on behalf of

.....
(Contractor's Name)

Signature.....
Name.....
Designation of.....
Authorized representative *

For and on behalf of

.....
(Employer's name)

Signature.....
Name.....
Designation of.....
Authorized representative*

WITNESS:

1. Signature.....
2. Name.....
3. Address.....

WITNESS :

1. Signature.....
2. Name.....
3. Address.....

* Indemnity-cum-Undertaking Agreement are to be executed by the authorized person and (i) in case of contracting Company under common seal of the Company or (ii) having the Power of Attorney issued under common seal of the company with authority to execute Indemnity- cum-Undertaking Agreement , (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity-cum-Undertaking Agreement . In case of Employer, by the authorized representative of the Employer.

SCHEDULE No.1

Particulars of the Equipments handed over	Quantity	Particulars of Despatch Title Documents	Value of the Equipments	Signature of Attorney in token of receipt
		RR/GR/Bill of Lading No & Date	Carrier	

(Please number subsequent schedules)

12. FORM OF AUTHORISATION LETTER

12. FORM OF AUTHORISATION LETTER

(NAME OF EMPLOYER)

(PROJECT)

REF.NO. :

DATE :

To,

M/s (Contractor's Name).....

Ref : Contract No..... Dated

for.....awarded by (Name of Employer)

Dear Sirs,

Kindly refer to Contract No..... Dated for(Contract Name) You are hereby authorized on behalf of(Name of Employer) having its registered office atand its Project at to take physical delivery of materials/equipment covered under dispatch Document/ Consignment Note no.....*dated.....andasdetailedintheenclosed Schedule for the sole purpose of successful performance of the aforesaid contract and for no other purposes, whatsoever.

(Signature of Project Authority) (Designation :

.....

Date.....

ENCL : as above

* Mention LR/RRNo.

**SCHEDULE OF MATERIAL/EQUIPMENT COVERED UNDER
DESPATCH TITLE DOCUMENT (RR NO./LRNO.....)**

Sl. No.	Contract Name	NOA No./ Contract Agreement No.	Description of Materials/No. Equipments	Spec.	Qty.	Value	Remarks
---------	---------------	---------------------------------	---	-------	------	-------	---------

(SIGNATURE OF THE PROJECT AUTHORITY)

(Designation).....

Date).....

13. DEED OF JOINT UNDERTAKING
(NOT APPLICABLE)

14. FORM OF BANK GUARANTEE
**BY ALL EXECUTANTS OF DEED OF JOINT
UNDERTAKING OTHER THAN CONTRACTOR**

(NOT APPLICABLE)

14.a PROFORMA FOR BANK GUARANTEE TO BE FURNISHED BY THE ASSOCIATE (NOT APPLICABLE)

(To be stamped in accordance with the Stamp Act, if any, of the Country of the issuing Bank) :

Bank Guarantee No.....

Date

In consideration of NVVN Ltd., (hereinafter referred to as “Employer” which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to with its Registered Head Office at..... (herein-after referred to as.....or “Contractor”) a

Contract for Package for its (Name of Project) vide Contract No. dated and the same

having been unequivocally accepted by the Contractor resulting in a “Contract”, which award is on the strength of Deed of Joint Undertaking dated (hereinafter referred to as “Undertaking”) given by M/s.....* (Contractor) and by (Associate/Collaborator) having its registered office at

..... (hereinafter called..... or Associate/

Collaborator), and the Contractor having further executed with (Associate/Collaborator) a Sub-Contract dated and the same having been unequivocally accepted by the Associate/Collaborator resulting in a Sub-Contract Agreement valued at for (hereinafter called “Sub-

Contract Agreement”) and (Associate/Collaborator) having agreed to provide a Performance Guarantee amounting to to the Employer on the terms and conditions specified in the “Undertaking”.

We..... Bank, having its Head Office at.....(herein-after referred to as the “Bank”, which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay to the Employer on demand any and all monies to the extent of(Specify currency and amount in words and figures) only as

aforsaid at any time upto.....@.....without any demur, reservation, context, recourse or protest and/or without any references to “Associate/Collaborator” or “Contractor”. Any such demand made by the Employer on the Bank shall be conclusive and binding, not withstanding any difference between the Employer and Contractor and/or

between the Employer and Associate/Collaborator or any dispute pending before any Court, Tribunal, Arbitrator or any other Authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Employer and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.

* Brief name of the Contractor

The Employer shall have the fullest liberty, without affecting in any way the liability of the Bank under this guarantee, from time to time to extend the time for performance of the Contract or the Sub-Contract Agreement by the Associate/Collaborator. The Employer shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Associate/Collaborator and to exercise the same at any time, in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract or Undertaking or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would, but for this provision have the effect of relieving the Bank from its obligations.

The Bank also agrees that the Employer at is option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against Contractor or Associate/Collaborator and notwithstanding any security or other guarantee that the Employer may have in relation to Contractor's or Associate's/ Collaborator's liabilities.

Notwithstanding anything contained hereinabove our liability under this guarantee is restricted to and, it shall remain in force upto and including@ and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s (Associate/Collaborator) on whose behalf this guarantee has been given.

Date this.....day of.....20.....at.....

WITNESS

1. (Signature)..... (Signature).....
(Name)..... (Name & Designation).....

(OfficialAddress).....

(Bank'sSeal).....

2. (Signature).....

Authorised vide Powerof

AttorneyNo.....

(Name).....

(Official

Date.....

Address).....

Notes :

1. @ The date shall be as specified in the corresponding format for the Deed of Joint Undertaking enclosed in the Section 'Forms and Procedures'.
2. The Bank Guarantee shall be from a Bank as per provisions of Section-V (SCC) of the bidding documents.
3. The stamp papers of appropriate value shall be purchased in the name of the Guarantee issuing Bank or the Party on whose behalf the BG is being issued. The Bank Guarantee shall be issued on a stamp paper of value as applicable in the State of India from where Bank Guarantee is issued or the State of India from where the BG shall be operated, whichever is higher.
4. While getting the Bank Guarantee issued, the Associate/contractor is required to ensure compliance to the points mentioned in Form 16-Form of Bank Guarantee Verification Check List enclosed with the bidding documents. Further, the contractor is required to fill up this Form 16 and enclose the same with the Bank Guarantee.

**14b. PROFORMA FOR BANK GUARANTEE
TO BE FURNISHED BY EXECUTENTS OF DEED OF
JOINT UNDERTAKING OTHER THAN CONTRACTOR**

(NOT APPLICABLE)

(To be stamped in accordance with the Stamp Act,
if any, of the Country of the issuing Bank) :

Bank Guarantee No.....

Date.....

In consideration of[Employer's Name] (hereinafter referred to as ‘‘Employer’’ which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to . with its Registered Head

Office at..... (herein-after referred to as or ‘‘Contractor’’) a Contract for Package for its (Name of Project) vide Contract No.dated..... and the same having been unequivocally accepted by the Contractor resulting in a ‘‘Contract’’, which award is on the strength of Deed of Joint Undertaking dated (hereinafter referred to as ‘‘Undertaking’’) given by M/s..... * (Contractor) and by (Dual Fuel Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) having its registered office at(hereinafter called.or (Dual Fuel Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company **) having agreed to provide a Performance Guarantee amounting to.to the Employer on the terms and conditions specified in the ‘‘Undertaking’’.

We..... Bank, having its Head Office at.....(hereinafter referred to as the ‘‘Bank’’, which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay to the Employer on demand any and all monies to the extent of(Specify currency and amount in words and figures) only as aforesaid at any time upto.....@.....without any demur, reservation, context, recourse or protest and/or without any references to (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) or ‘‘Contractor’’. Any such demand made by the Employer on the Bank shall be conclusive and binding, notwithstanding any difference between the Employer and Contractor and/or between the Employer and (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) or any dispute pending before any Court, Tribunal, Arbitrator or any other Authority. The Bank undertakes not to revoke this Guarantee during its currency without previous consent of the Employer and further agrees that the Guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.

* Brief name of the Contractor

The Employer shall have the fullest liberty, without affecting in any way the liability of the Bank under this Guarantee, from time to time to extend the time for performance of the Contract or the Sub-Contract Agreement by the (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company). The Employer shall have the fullest liberty, without affecting this Guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) and to exercise the same at any time, in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract or Undertaking or any other course or remedy or security available to the Employer. The Bank shall not be released of its obligations under these presents by any exercise of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would, but for this provision have the effect of relieving the Bank from its obligations.

The Bank also agrees that the Employer at is option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against Contractor or (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) and notwithstanding any security or other guarantee that the Employer may have in relation to Contractor's or (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) liabilities.

Notwithstanding anything contained hereinabove our liability under this Guarantee is restricted to and, it shall remain in force upto and including @and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s (Gas Engine Manufacturer**/Holding Company**/Subsidiary of Holding Company) on whose behalf this guarantee has been given.

Date this..... day of 20 at

WITNESS

(Signature)..... (Signature).....

(Name)..... (Name & Designation).....

(Official Address)..... (Bank's Seal).....

Authorized vide Power of Attorney No.....

Notes: Date.....

1. @ The date shall be as specified in the corresponding format for the Deed of Joint Undertaking enclosed in the Section 'Forms and Procedures'.
2. The Bank Guarantee shall be from a Bank as per provisions of Section-V (SCC) of the Bidding Documents.

15. FORM OF JOINT VENTURE AGREEMENT

--NOT APPLICABLE--

**16. FORM OF BANK
GUARANTEE VERIFICATION
CHECKLIST**

BANK GUARANTEE VERFICATION CHECKLIST

1. Bank Guarantee No.
2. Issuing Bank
3. Amount of BG
4. Nature of BG & No. of Pages
5. Validity of BG
6. Package Description
7. Party & Contracts Ref.
8. Bank Reference

CHECK LIST

S.No.	Details of Checks	Yes/No
a)	Is the BG on non-judicial stamp paper of appropriate value, as per Stamp Act?	
b)	Whether date, purpose of purchase of stamp paper and name of the purchaser are indicated on the back of stamp paper under the Signature of Stamp vendor? (The date of purchase of stamp paper should be not later than the date of execution of BG and the stamp paper should be purchased either in the name of the executing Bank or the party on whose behalf the BG has been issued.	
c)	In case the BG has been executed on Letter Head of the Bank, whether adhesive Stamp of appropriate value has been affixed thereon?	
d)	Has the executing Officer of BG indicated his name, designation and Power of Attorney No. / Signing Power No. etc. on the BG?	
e)	Is each page of BG duly signed/initiated by executant and whether stamp of Bank is affixed thereon? Whether the last page is signed with full particulars including two witnesses under seal of Bank as required in the prescribed proforma?	

S.No.	Details of Checks	Yes/No
f)	Does the Bank Guarantees compare verbatim with the Proforma prescribed in the Bid Documents?	
g)	In case of any changes in contents of text, whether changes are of minor/clerical nature (which in no way limits the right of NVVN in any manner)?	
h)	In case of deviations in text of BG, which materially affect the right of NVVN, whether the changes have been agreed based on the opinion by Legal Department or BG is considered acceptable on the basis of opinion of Law Departmental ready available on the similar issue.	
i)	Are the factual details such as Bid Document No., NOA / LOA / Contract No., Contract Price, Percentage of Advance, Amount of BG and Validity of BG correctly mentioned in the BG?	
j)	Whether overwriting / cutting if any on the BG have been properly authenticated under signature & seal of executant?	
k)	Whether the BG has been issued by a Bank in line with the provisions of BG / Contract Documents?	
l)	In case BG has been issued by a Bank other than those specified in Bid/Contract Document, is the BG confirmed by a Bank in India acceptable as per Bid/Contract Documents?	

----- Date :

Signature.....
 Place : Printed Name.....
 (Designation).....
 (Common Seal).....

Note: The Bidder is required to fill up this form and enclose along with the Bank Guarantee.

**17. FORM OF VALIDITY EXTENSION OF BANK
GUARANTEE**

FORM OF VALIDITY EXTENSION OF BANK GUARANTEE

(To be stamped in accordance with the Stamp Act, if any, of the Country of the issuing Bank):

Ref.No.....

Dated :.....

To :
[Employer's Name and Address]

Dear Sirs,

Sub : ValidityExtensionofBankGuaranteeNo.....dtd.....
for favouring yourselves, expiringon.....
on account of M/s*.....in
respect of Contract/Bid document for (Insert package name).....
for (Insert Project name) project, Contract No./Bid
Document No.....dated..... (Hereinafter called original
Bank Guarantee).

At the request of M/s*.....we..... Bank
having branch office at and having Head Office at
..... do hereby extend our liability under the above mentioned Bank
Guarantee No..... dt for a further period of.....Years/Months from to
expire on.....

Except as provided above, all other terms and conditions of the original Bank Guarantee
No.....dt..... shall remain unaltered and binding onus.

Please treat this as an integral part of the original guarantee to which it would be attached.

.....
(Signature)

.....
(Name)

.....
(Designation with Bank Stamp)
Authorized vide Power of Attorney No.....

Dated.....

Note:1.*In case of Joint Ventures, name of all partners of the Joint Venture shall be mentioned. **NOT**

APPLICABLE

2. The extension of BG should be on Non-Judicial stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG is executed, whichever is higher. The Stamp Paper/e-Stamp paper shall be purchased in the name of Bidder/Bank issuing the guarantee.
3. The extension of the Bank Guarantee should be forwarded to the Unit/Project/Corporate Centre, from where the extension has been sought

18. FORM OF CONTRACT CLOSING CERTIFICATES

PROFORMA OF CERTIFICATE OF FINAL AMENDMENT TO THE CONTRACT

(To BE ISSUED BY CORPORATE CONTRACT SERVICES)

CERTIFICATE NO. CCP - 01

NAME OF PACKAGE:

**LETTER OF AWARD/ NOA/
CONTRACT NO. :**

NAME OF CONTRACTOR

DATED:

This is to certify that amendments have been issued to the aforesaid contract as per the details mentioned below:

	Amendment No.	Date
1.		
2.		
3.		
4.		
5.		

This is to certify further that Amendment No.----- dated is the last amendment issued.

Signature

Date
Place.....

Name.....
Designation

PROFORMA FOR DRAWING RECEIPT CERTIFICATE

(TO BE ISSUED BY ENGINEERING)

CERTIFICATE NO.CCP- 02

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO.:**

NAME OF CONTRACTOR

DATED:

Project:

This is to certify that we have received all the drawings which were to be submitted by the Contractor in requisite number along with the reproducibles as detailed in Annexure enclosed herewith, as per provisions stipulated in the above mentioned LOA/Contract.

Signature

Date
Place.....

Name... ..
Designation

PROFORMA FOR QA DOCUMENTS RECEIPT CERTIFICATE

(TO BE ISSUED BY CQA&I)

CERTIFICATE NO. CCP-03

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO. :**

NAME OF CONTRACTOR:

DATED:

Project:

This is to certify that the QA documents as per the list enclosed, in respect of the above mentioned LOA/ Contract has been received in line with the provisions of the Contract.

Signature

Date

Name.....

Place.....

Designation

PROFORMA FOR O&M MANUAL RECEIPT CERTIFICATE

(TO BE ISSUED BY ENGINEERING)

CERTIFICATE NO. CCP - 04

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO. :**

NAME OF CONTRACTOR:

DATED:

Project :

This is to certify that we have received from the contractor all the necessary O&M Manuals in requisite number including the list of spare parts along with the names of vendors in respect of the above LOA/contract. The consolidated list of such manuals received is enclosed along with the distribution as marked on the list.

Signature

Date.....
Place.....

Name... ..
Designation.....

PROFORM FOR SCOPE COMPLETION CERTIFICATE

(TO BE ISSUED BY SITE ERECTION)

CERTIFICATE NO. CCP- 05

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/CONTRACT NO.:**

NAME OF CONTRACTOR:

DATED:

Project :

1. This is to certify that the scope of the above Contract has been completed in line with the contract read in conjunction with the following documents:
 1. Final Amendment No. _____ (As per CCP -01)
 2. Approved drawings including site run pipingschemes, if any.
 3. Approved Bill of Materials
 4. Material Dispatch Clearance Certificate (s)
 5. Measurement Book
 6. AsBuilt Drawings
 7. Any other documents (specify)

2. It is further certified that the following have been supplied, as per the details given in the Contract Documents and the same have been taken over by NTPC.
 1. Mandatory Spares
 2. Recommended Spares
 3. Special Tools & Tackles

Signature

Date

Name.....

Place.....

Designation

PROFORMA FOR LIQUIDATED DAMAGES FOR DELAY CERTIFICATE

(TO BE ISSUED BY SITE ERECTION/ REGIONAL OFFICE/ CORPORATE CONTRACT SERVICES)

CERTIFICATE NO. CCP- 06

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO. :**

NAME OF CONTRACTOR:

DATED:

Project:

This is to certify that the issue regarding liquidated damages for delay as per the provisions of clause _____ of the above contract/ LOA has been resolved with the approval of the Competent authority vide reference _____ (copy enclosed).

Signature

Date

Name.....

Place.....

Designation

Note: In respect of cases where LD for delay is settled by Corporate Contract Services (CS), this certificate will be issued by CS and where LD for delay is settled by the Site / Region, the same will be issued by the concerned Site/Regional Offices.

PROFORMA OF SHORTFALL IN EQUIPMENT PERFORMANCE CERTIFICATE

(TO BE ISSUED BY OS/SITE, AS APPLICABLE, FOR SITE PERFORMANCE TEST AND BY CQA&I FOR SHOP TEST)

CERTIFICATE NO. CCP - 07

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO.:**

NAME OF CONTRACTOR:

DATED:

PROJECT:

This is to certify that the following shortfall in equipment performance as compared to the guaranteed parameters have been assessed and agreed to with the contractor in respect of the above mentioned LOA/ Contract.

S.No	Guaranteed Parameter	Guaranteed value	Assessed Value	Shortfall, if any.	liquidated damages Annual
1	2	3	4	5	6

Further, it is also confirmed that liquidated damages for shortfall in equipment performance in respect of above Items, have been recovered fully from the contractor and no other dues are outstanding for shortfall in equipment performance.

Signature

Date

Name.....

Place.....

Designation

To be counter signed by Site Accounts.

Signature

Date.....

Name.....

Place.....

Designation

PROFORMA OF "MATERIAL RECONCILIATION" CERTIFICATE

(TO BE ISSUED BY SITE ERECTION AND COUNTERSIGNED BY SITE MATERIALS MANAGEMENT)

CERTIFICATE NO. CCP- 08

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO.:**

NAME OF CONTRACTOR:

DATED:

PROJECT:

This is to certify that the materials issued to the contractor in respect of the above mentioned LOA/Contract have been reconciled with the stipulations under the contract documents and no other recovery of material is pending with the contractor.

Signature

Date

Name.....

Place.....

Designation

To be counter signed by materials management

Signature

Date

Name.....

Place.....

Designation.....

PROPORMA OF "PAYMENT RECONCILIATION" CERTIFICATE
(TO BE ISSUED BY SITE ACCOUNTS IN CASE OF INDIAN CONTRACTORS)

CERTIFICATE NO. CCP - 09

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO. :**

NAME OF CONTRACTOR:

DATED:

PROJECT:

This is to certify that all the payments released to the contractor in respect of the above mentioned LOA/Contract have been reconciled with the provisions of the contract documents and statement of Accounts and or other Certificates of Contractor. It is observed that there are no recoveries pending under any of the items listed overleaf.

Signature

Date.....
Place.....

Name.....
Designation.....

Enclosure to CCP-09

The list of recoveries and claims as advised by site Erection Department should include all recoveries and claims on any account whatsoever, including the following:

1. Liquidated damages for delay.
2. Liquidated damages for shortfall in Performance as observed during shop-testing (by inspection deptt.)
3. Liquidated damages for shortfall in performance as observed during performance guarantee tests conducted at site and other site tests.
4. All recoveries /claims on account of variations/deviations to scope of contract permitted or otherwise taken place during execution of the contract as listed in certificate No. CCP.05 for contract closing (Certificate by site Erection for contract closing).
5. Recoveries on account of reconciliation of payments made under the contract.
6. All the claims against the contractor regarding clearance of materials from site and vacation of the premises allotted for site office, stores.
7. All claims in respect of Training/Transportation/Accommodation/Services provided by site in respect of above LOA/Contract.
8. Recoveries on account of settlement of insurance claims
9. Recoveries on account of reconciliation of materials issued to the Contractor.
10. All recoveries on account of demurrage, transportation, insurance premiums etc. and other recoveries as informed by T&CC group on account of port clearance, transportation etc.
11. All recoveries on account of wastage and scrap.
12. All recoveries/claims (if any) on account of maintenance of equipments.
13. All recoveries/claims (if any) on account of price variation.
14. All recoveries/claims (if any) on account of statutory dues paid on behalf of the Contractor by NTPC.
15. Royalty charges.
16. All recoveries/ claims (if any) on account of hiring out of NTPC's plant and equipment.
17. All recoveries/claims (if any) on account of water and electricity charges (if applicable).
18. Any other recoveries/claims against specific instructions.

PROFORMA OF CERTIFICATE REGARDING LABOUR PAYMENTS AND STATUTORY REQUIREMENTS TO BE FURNISHED BY CONTRACTOR.

(TO BE ISSUED BY THE CONTRACTOR)

CERTIFICATE NO. CCP - 10

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO. :**

NAME OF CONTRACTOR:

DATED:

PROJECT:

This is to certify that we have made all labour payments including PF Liabilities in respect of the above mentioned LOA/ Contract and no other payments in this regard is pending from us.

Further we confirm that all Statutory requirements have been complied with by us and in case any default is reported against us, we shall be solely responsible for the same.

Signature

Date

Name.....

Place.....

Designation

PROFORMA OF "NO DEMAND CERTIFICATE" BY CONTRACTOR (TO BE ISSUED BY THE CONTRACTOR)

CERTIFICATE NO. CCP-11

NAME OF PACKAGE:

**LETTER OF AWARD/ NOA/
CONTRACT NO. :**

NAME OF CONTRACTOR:

DATED:

PROJECT:

We, M/s (Contractor) do hereby acknowledge and confirm that we have received the full and final payment due and payable to us from NTPC Ltd. in respect of our aforesaid LOA/Contract No..... dated.....including amendments if any, issued by NTPC Ltd., to our entire satisfaction and we further confirm that we have no claim whatsoever pending with NTPC Ltd. under the said Contract.

Notwithstanding any protest recorded by us in any correspondence document, measurement books, and/or final bills etc., we waive all our rights to lodge any claim or protest in future under this contract.

We are issuing this "NO DEMAND CERTIFICATE" in favour of NTPC Ltd. with full knowledge and with our free consent without any undue influence, misrepresentation, coercion etc.

Signature

Date

Name.....

Place.....

Designation

(Company CommonSeal)

(This certificate shall be accompanied by the Power of attorney of the signatory)

**PROFORMA OF CERTIFICATE FOR COMPLETION OF WARRANTY PERIOD (TO
BE ISSUED BY SITE ERECTION)**

CERTIFICATE NO. CCP-12

NAME OF PACKAGE:

**LETTER OF AWARD/
NOA/ CONTRACT NO.:**

NAME OF CONTRACTOR:

DATED:

PROJECT:

This is to certify that the warranty period for the above mentioned LOA/Contract has been completed in line with the provisions of the contract.

Signature

Date

Place.....

Name... ..

Designation

PROFORMA OF "CERTIFICATE FOR RETURN OF BGs/ INDEMNITY BONDS ETC."

(TO BE ISSUED BY SITE ACCOUNTS)

CERTIFICATE NO.
CCP-13

NAME OF PACKAGE:

**LETTER OF
AWARD/NOA/
CONTRACT NO.:**

NAME OF CONTRACTOR:

DATED:

PROJECT:

This is to certify that all the *Bank Guarantee/ Indemnity bonds/ Insurance policies/ Collaborator's or Associate's Guarantee received for the above mentioned LOA/ Contract have been returned in original to the contractor.

Signature

Date.....
Place.....

Name.....
Designation.....

Form of certificate regarding Bank Guarantee charges

TO WHOMSOEVER IT MAY CONCERN

This is to certify that we have issued/ extended/ amended Bank Guarantee (BG) Number..... amounting to (in number and words in Contract Currency) in favour of NTPC Limited on behalf of M/S (Contractor name) vide their request reference..... dated..... (DD/MM/YYYY) for the period (from)..... (to).....

We confirm that the bank commission (excluding Stamp paper, Out of Pocket Expenses (OPE) and GST on OPE) amounting to (amount and currency) for issuance/ extension/ amendment of the aforesaid BG have been recovered from M/s(Contractor name).

We further confirm that the commission charged on issuance/ extension/ amendment of the aforesaid BG is as per the prescribed rates of the Bank. Further the commission charged by the Bank as per card rates / sanctioned rates is customer/ borrower specific and is uniform for all BGs issued at the request of said customer/ borrower irrespective of beneficiary.

Chief Manager/Branch Manager SS No: -

ABC Bank Ltd New

Delhi.

(With Seal of Bank Official)

20. FORM OF INDEMNITY-CUM-UNDERTAKING AGREEMENT [FOR REMOVAL / DISPOSAL OF SCRAP / SURPLUS MATERIAL]

(TO BE EXECUTED ON STAMP PAPER OF APPROPRIATE VALUE)

INDEMNITY-CUM-UNDERTAKING AGREEMENT

THIS INDEMNITY-CUM-UNDERTAKING AGREEMENT executed this day of 20 between (Name of Company) a Company / Partnership Firm / Proprietary Concern incorporated under the laws of having its Registered Office(s) at (Office Address) hereinafter called the "Contractor" (which expression shall, unless excluded by or repugnant to the context, be deemed to mean and include its successors, administrators, executors and permitted assigns)

AND

M/s. having its registered office at (Hereinafter referred to as „Employer“).

1. „Employer“ has awarded the „Contractor“, contract for execution of work ("Scope of Work") as mentioned in the contract agreement no dated, entered into between „Employer“ and „Contractor“, relating to (Name & Address of Project/Station) (Hereinafter called 'the Project').
2. The „Contractor“ for the purpose of execution of its Scope of Work had from time to time procured and stored (Details of Material) at the Project Site.
3. After completion of the Scope of Work by „Contractor“, it has been identified that scrap (Details of Scrap Material & its quantity) and/or surplus (Details of Surplus Material & its Quantity) belonging to „Contractor“ is lying at the said Project Site.
 4. Now, the scrap (Details of Scrap Material & its Quantity) and/or surplus (Details of Surplus Material & its Quantity) belonging to the „Contractor“, requires to be removed by „Contractor“ from the Project Site.

NOW THEREFORE THIS INDEMNITY-CUM-UNDERTAKING AGREEMENT WITNESSETH AS UNDER:

1. That „Contractor“ by way of this Indemnity-cum-Undertaking Agreement requests „Employer“ to issue necessary exit gate pass(es) in favor of „Contractor“ for removal of scrap (Details of Scrap Material & its Quantity) and/or Surplus (Details of Surplus Material & its Quantity) belonging to „Contractor“, from the project.

2. That as per Employer's procedure, „Contractor“ shall ensure loading of trucks for clearing of its scrap.....(Details of Scrap Material & its Quantity)..... and/or surplus (Details of Surplus Material & its Quantity) by itself, as aforesaid, under the supervision of CISF personnel.

3. That „Contractor“ in consideration of the premises above, for itself and its respective, executors, administrators and assigns, jointly and severally agree and undertake from time to time and at all times hereafter to indemnify „Employer“ and keep „Employer“ indemnified from and against all claims, demands, actions, liabilities and expenses which may be made or taken against or incurred by „Employer“ by reason of the issue of necessary gate pass(es) by „Employer“ and permitting „Contractor“ to remove scrap(Details of Scrap Material & its Quantity).....and/or surplus (Details of Surplus Material & its Quantity)..... belonging to „Contractor“, from the project.

4. That „Contractor“ undertakes to indemnify and keep „Employer“ harmless from any act of omission or negligence on the part of the „Contractor“ in following the statutory requirements with regard to removal/disposal of scrap and surplus belonging to „Contractor“, from the Project Site aforesaid, by the “Contractor”. Further, in case the laws require „Employer“ to take prior permission of the relevant Authorities before handing over the scrap and/or surplus to the “Contractor”. the same shall be obtained by the „Contractor“ on behalf of „Employer“.

IN WITNESS WHEREOF, the „Contractor“ and the „Employer“, through their authorized representative, have executed these presents on the Day, Month and Year first mentioned above at (Name of the Place).....

For and on behalf of

(Contractor’s Name)

For and on behalf of

(Employer’s name)

Signature.....
 Name.....
 Designation of.....
 Authorized representative *

Signature.....
 Name.....
 Designation of.....
 Authorized representative*

WITNESS:

1. Signature.....
2. Name.....
3. Address.....

WITNESS :

1. Signature.....
2. Name.....
3. Address.....

- * Indemnity-cum-Undertaking Agreement are to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the Power of Attorney issued under common seal of the company with authority to execute Indemnity-cum-Undertaking Agreement , (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity-cum-Undertaking Agreement . In case of Employer, by the authorized representative of the Employer.