**BHARAT HEAVY ELECTRICALS LTD.**
**(TRANSMISSION BUSINESS GROUP)**
**GENERAL TERMS AND CONDITIONS FOR TENDER ENQUIRY**

**This Format is to be submitted in original duly signed and stamped by bidder. Deviation, if any, is to be brought out clearly in Schedule of Commercial deviation giving clause wise deviation. Any condition / clarification / deviation mentioned elsewhere will not be accepted.**

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| 1. | 1. Sealed bids are invited for the items mentioned in the enquiry conforming to specifications. Bids should be typed and free from over writing and erasures, corrections or additions must be clearly written both in words and figures and attested and otherwise offer may be liable for rejection.<br><br>2. Bidder to ensure that quotation is received / dropped in the tender box on or before **14.00** Hrs. as per Indian standard time (IST) of the due date of opening in<br>**Material Management Division,**<br>**Transmission Business Group,**<br>**Tower-A, 5th Floor, Advant Navis IT Business Park**<br>**Plot-7,Sector-142,**<br>**Expressway Noida, Noida-201305, UP, India**<br><br>3. The tenders will be opened on due date at **14.30** Hrs. as per IST in the presence of participating vendors, who may like to be present. Tenders received late are liable for rejection. Vendors should ensure that an offer is delivered in time.<br><br>4. Bids are to be submitted in Two parts:<br><br>**Part-I: Qualification Criteria/Technical / Commercial Bid ( in two copies)**<br><br>**Part-II: Price Bid**<br><br>**Part-I Envelopes super scribed with Technical / Commercial Bid to contain information regarding, among others:**<br>1. Specification<br>2. Deviations (if any) in deviation sheet of BHEL's Format.<br>3. All commercial terms, Un-priced copy of Price Bid with units for measurement.<br>4. Delivery terms & period required for supply from order, Filled in activity Schedule format<br>5. Evidence for Qualification criteria.<br>**Part-II** Envelopes super scribed with Price Bid should contain priced copy of Price Bid. The price should be mentioned both in figures and words. Price bid containing any additional information is liable for rejection. In case of any difference between figures and words, the quoted rate in words will prevail over figure. If there is a calculation mistake in multiplication of unit rate with quantity, then the unit rate quoted will be considered for calculation.<br><br>Both Part I and Part II bids are to be kept in separate envelopes and both envelopes to be kept in another common envelope. Each envelope should be sealed and super scribed with enquiry no., item / package name, project name and due date of opening.<br><br>**Note: 1 Representative deputed to witness tender opening must produce an authority letter from the signatory of offer at the time of tender opening.**<br><br>**Note: 2 Authorized signatory should authenticate tender documents.**<br><br>**Note: 3 The bid of bidder will be accepted subject to vendor approval by Customer. Vendor to submit the credentials in the format attached with the enquiry along with the offer.** |

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| | 5. For any Technical clarification, please contact<br>Ms. Muneet Mehta, Manager (TBEM)<br>BHEL, Transmission Business Group,<br>Tower-A, 5th Floor, Advant Navis IT Business Park<br>Plot-7,Sector-142, Expressway Noida, Noida-201305, UP, India<br>Phone : +91 (0) 0120- 6748134,<br>Fax: +91 (0) 0120 – 6748518.<br>e-mail : muneet@bhel.in<br><br>For any commercial clarification please contact person issuing enquiry.<br>Mr. S. C. Shivhare, Sr. Manager-TBMM<br>or, Smt. Archana Kumari, Sr. Engr.-TBMM<br>BHEL, Transmission Business Group,<br>Tower-A, 5th Floor, Advant Navis IT Business Park<br>Plot-7,Sector-142, Expressway Noida, Noida-201305, UP, India<br>Phone : +91 (0) 0120- 6748471/8467,<br>Fax: +91 (0) 0120 – 6748581.<br>e-mail :scshivhare@bhel.in / archanak@bhel.in<br><br>6. Unsolicited Supplementary / Revised price bid submitted during validity period of offer, unless asked by BHEL, shall not be considered. Withdrawal of quotation by the vendor, at any stage after submission, may entail action.<br><br>7. If scope also includes site activities (i.e. Supervision, Erection, Installation, Testing and Commissioning of the equipment / material), separate contracts may be awarded for Supply portion and Site execution portion. For Supply portion General Terms and Conditions mentioned here shall be applicable. For Site execution portion, Terms and conditions for Installation services shall be applicable. However, any breach in either of the contract shall be deemed as the breach of other contract also. |
| 2. | **PRICES:**<br>**A. The prices as quoted in price schedule remain firm after adjustment by the PVC adjustment formula attached with the enquiry.**<br><br>**<u>Project Status</u>: Domestic. Excise Duty, CST, CD are payable by vendor.**<br><br>**<u>For Foreign Bidder:</u>**<br><br>**The break-up of the prices shall be as mentioned in the schedule of price format.**<br>i. FOB / CIF (Port of loading) including sea worthy packing & forwarding charges.<br>ii. Marine Freight. From port of loading to discharge port<br>iii. Insurance. .....do.....<br>iv. Vendor to mention Port of Loading (…….)<br>v. Destination Port (Mumbai)<br><br>**Foreign vendors to quote Freight & Insurance charges from port of loading to port of discharge (Mumbai). However, in case of insurance by foreign vendor, the beneficiary shall be BHEL only.**<br><br>***Loading shall be done on foreign vendors for* Custom Clearance charges as well as Custom Duty at Port and *for transportation from Port of Discharge to site including insurance and all other associated Charges, Taxes & duties involved till delivery of goods at site. However, foreign vendor can also quote for inland transport (From Mumbai Port to Site).*** |

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| | **Type Test charges**: As mentioned in technical specification **– The supplier shall conduct the type tests as per relevant IEC standards and no extra cost shall be paid by BHEL.**<br><br>**Laying, Erection, Testing and Commissioning charges:** As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.<br><br>**Training at Supplier's Works / Site: -** As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.<br><br>**Service Tax:** Applicable towards Erection, Testing & Commissioning & Training (if any) and type test charges as per the current prevailing rate in India.<br><br>**NOTE: Please note that in case training / Type Test is conducted outside India, taxes / duties outside India shall be in scope of bidder and included in their quoted prices.**<br><br>**For evalua*tion purpose:***<br><br>**Price quoted in any currency will be converted to Indian rupee at the TT Selling Rate of SBI in India on the date of Techno – Commercial Bid opening.**<br><br>**For Indigenous bidder:**<br><br>The prices are to be quoted on **FOR** (Destination) basis. The break-up of price shall be as under:-<br>**a) Ex-works Price:** Ex- works price including packing & forwarding charges.<br>**b) Excise duty: ED as applicable is to be quoted as percentage in both un-price and price bid.**<br>**c) Sales Tax:** ST / VAT / CST (against C-form) to be quoted as percentage in un-price and price bid. In case of interstate sale-in-transit supplier have to provide E1/E2 form.<br><br>**d) Entry tax / Octroi Charges:** Any Entry tax / Octroi applicable at destination / destination state shall be paid extra on proof of such payment.<br><br>**e) Freight & Insurance:** Freight and Transit Insurance for door delivery up to destination/store is to be quoted.<br><br>***f)* Service Tax:** Applicable towards Erection, Testing & Commissioning & Training (if any) and type test charges as per the current prevailing rate in India.<br><br>**g) Type Test charges:** As mentioned in technical specification **– The supplier shall conduct the type tests as per relevant IEC standards and no extra cost shall be paid by BHEL.**<br><br>**h) Laying, Erection, Testing and Commissioning charges:** As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.<br><br>**i) Training at Supplier's Works / Site: -** As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.<br><br>**NOTE:** |

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| | **The purchase order shall be placed on Ex- Works basis for Indian Vendor.**<br><br>**For overseas Vendor, the order is proposed to be placed on CIF basis. However, BHEL reserves the right to convert the order on FOB also. The evaluation of bids shall be done on delivered cost to BHEL, in such case the F & I charges from discharge port to site shall be loaded on CIF value quoted by the overseas vendors.**<br><br>**"BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.**<br><br>**In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue."**<br>**(Further to above clause, please refer attached Annexure I for Terms & Conditions Of Reverse Auction Page 1 & 2)** |
| 3. | **TERMS OF PAYMENT:- For Overseas Vendors:**<br><br>**FOR SUPPLY PORTION**:-<br><br>i) By irrevocable LC (With Usance Period of 60 days, to be counted from the date of presentation of documents in LC opening bank) which will be opened after placement of order and receipt of performance bank guarantee for 10% of order value. All bank charges to supplier's account.<br><br>**90%** against original invoice, original bill of lading, packing list, MICC (dispatch clearance given by BHEL), guarantee certificate, transit insurance certificate, certificate of origin.<br><br>**ii) "10% direct payment within 60 days from the date of confirmation of material receipt by BHEL Site and against submission of invoice to BHEL TBG."**<br><br>**NOTE: In regards LC Payment, please note that all bank charges are in beneficiary account. Period of presentation should be 7-10 working days from the date of shipment / invoice whichever is later. However, documents must reach LC opening bank within 21 days of date of B / L.**<br><br>**FOR INSTALLATION SERVICES:**- Direct payment on prorate basis within 60 days as follows:<br>**1.** 90% payment after measurement acceptance of respective services by BHEL Site and submission of bill by the vendor for the same.<br>**2.** 10% payment after successful testing & commissioning of entire cable system as per the scope of contract.<br><br>**Terms of payment for Training charges:**<br><br>100% direct payment with full taxes and duties on completion of training within 60 days from the date of receipt of invoice. Documents (original + 2 copies) required for payment.<br>- Invoice<br>- Training completion certificate from BHEL.<br>**TERMS OF PAYMENT:- For Indian Vendors:** |

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| | 100 % Payment with Taxes, Duties, Freight & Insurance within 60 days (**45 Days for MSE vendor**) from the date of receipt of complete invoice with following documents in 3 sets (Original + 2 copies):<br>- LR duly endorsed in the name of customer by BHEL site<br>- Receipt of material on the attached format by BHEL site<br>- Excise invoice (If Applicable)<br>- Delivery Challan or Packing list (case wise)<br>- Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers<br>- MICC<br>- Guarantee Certificate<br>- Copy of Performance Bank Guarantee.<br><br>[A.] Documents to be furnished by vendor immediately after dispatch:<br><br>- Copy of Invoice<br>- Copy of LR<br>- Copy of Delivery Challan / Packing List<br>- Copy of Insurance Certificate<br>- Copy of Guarantee Certificate<br><br>[B.] Following Documents to be sent by vendor to TBG, BHEL :<br><br>- LR duly endorsed in the name of customer by BHEL site<br>- Receipt of material on the attached format by BHEL site<br>- Excise invoice (If Applicable)<br>- Delivery Challan / Packing list (case wise)<br>- Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers<br>- Dispatch Clearance / MICC<br>- Guarantee certificate<br>- All Test & Inspection Reports<br><br>**FOR INSTALLATION SERVICES:**- Direct payment on prorate basis within 60 days as follows:<br>**1.** 90% payment after measurement acceptance of respective services by BHEL Site and submission of bill by the vendor for the same.<br>**2.** 10% payment after successful testing & commissioning of entire cable system as per the scope of contract.<br><br>**Terms of payment for Training charges:**<br>100% direct payment with full taxes and duties on completion of training within 60 days from the date of receipt of invoice. Documents (original + 2 copies) required for payment.<br>- Invoice<br>- Training completion certificate from BHEL.<br><br>**INTEREST LIABILITY**<br>In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment. |
| 4 | **GUARANTEE / DEFECT LIABILITY: AS PER ATTACHED ANNEXURE TO NIT – A of 9 Pages** |
| 5. | **SECURITY CUM PERFORMANCE BANK GUARANTEE**:<br><br>**OPTION -A**<br><br>**For Overseas Vendors:**<br>In the event of an order, tenderer shall furnish BG towards Security Cum |

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| | Performance for 10% of total value of P.O.(for supply portion), within two weeks of placement of P.O. valid till 60 days beyond the guarantee period, from any schedule bank subject to acceptance by TBG/BHEL Finance<br><br>**For Indian Vendors:** Bidder shall furnish along with first invoice Performance BG / deposit as per following options.<br><br>BG for 10% of the total Ex-works PO value, initially valid for 18 months + 3 months claim period (i. e. total 21 months) from the date of last delivery<br><br>**In case BG period is expiring before expiry of Guarantee Period, vendor (applicable for both Indian as well overseas vendors) will have to keep the BG extended suitably till the end of Guarantee Period. In case of foreign vendors, BG will be required to be submitted before opening of L/C.**<br><br>All the Bank Guarantee shall be from a scheduled bank (As Per list attached) in India acceptable to BHEL. The original BG should be sent by issuing bank directly to AGM (Finance), TBG, BHEL, Noida. BANK Guarantee should be valid for lodging claim within two months after expiry of guarantee period.<br><br>**OPTION-B( Applicable for Indian as well as Overseas Vendors)**<br>Retention of 10% of the total Ex-works PO value by BHEL from the first bill in lieu of Performance Bank Guarantee, to be released after expiry of Guarantee Period.<br><br>**If no option is specified, by default option – A shall be considered for confirmation** |
| 6. | **INSPECTION:** BHEL and/or customer will inspect the Equipment/Material before dispatch. In the event BHEL / Customer waives off inspection, TEST REPORTS and RESULTS shall be submitted by vendor for approval by BHEL / Customer. Based on that MICC (Material Inspection Clearance Certificate) / MDCC shall be issued by BHEL.Material to be dispatched only after getting Dispatch Clearance from BHEL.<br>BHEL / Customer may also carry out stage inspection during manufacturing of the ordered item.<br>Supplier shall send inspection call on prescribed format only with an advance notice of 15 days. |
| 7. | **DISPATCH DOCUMENTS:** Dispatch documents (Negotiable documents) shall normally comprise Original Invoice, Bill of Lading/LR, Shipping / Packing lists (case wise), Certificate of country of origin, Material Inspection Clearance certificate (MICC), Test Certificates & approval of acceptance & routine test certificates, Insurance certificate and manufacturer's guarantee certificate. |
| 8. | **DELIVERY PERIOD:** Bidder to specify delivery period in weeks from the date of LOI / PO in the activity schedule format enclosed with enquiry. Time for conducting the type test, if required, is to be separately indicated.<br><br>Note: BOL/LR date or Invoice date whichever is later shall be considered as delivery date for supply portion and date of completion of installation work shall be considered as delivery date for installation work. |
| 9. | **DELAYED DELIVERY:** In case of delay in execution of order beyond the lot wise contractual delivery, an amount of ½ % of total Ex-Works / FOB Value per week or part there-of subject **to maximum of 10 %** of total Ex-Works / FOB value of P.O. will be withheld. |
| 10. | **VALIDITY:** The offer shall be valid for 120 days from the due date of opening. |
| 11. | **ACCEPTANCE / REJECTION OF TENDER**: BHEL reserves the right to reject in full or part, any or all tender without assigning any reason thereof.<br>BHEL also reserves right to vary the quantities mentioned in the tender. |

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| 12. | **EVALUATION:** Comparative statement shall be prepared based on overall quantity unless otherwise indicated in the enquiry. Evaluation of offers shall be done on the basis of delivered cost to BHEL. |
| 13. | **DEVIATION:** The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may **load the prices for evaluation of offer as mentioned at Sl. No. - 23.** |
| 14. | **ARBITRATION:**<br><br>All cases of disputes emanating from and relating to this contract shall be referred to the sole arbitrator appointed by Unit Head / GM, BHEL. The arbitrator may be an employee of BHEL whether serving or retired or any other person nominated by Unit Head/GM BHEL. The arbitration shall be in accordance with 'The Arbitration and Conciliation Act 1996' and the rules there under as amended from time to time. The arbitrator shall give a reasoned award. The decision of the arbitrator shall be final & binding upon both the parties.<br><br>The venue of arbitration shall be Delhi. |
| 15. | **LEGAL SETTLEMENT:** All disputes shall be subject to jurisdiction of court situated in Delhi / New Delhi only.<br><br>Notwithstanding contained herein anything in this NIT, the original exclusive jurisdiction shall remain of the court at Delhi / New Delhi. |
| 16. | **SUBCONTRACTING :**<br>In case further subcontracting of BHEL order or part thereof is envisaged by vendor, the same can be done only after written permission is obtained from BHEL. However it shall not absolve the vendor of the responsibility of fulfilling BHEL purchase order requirements. |
| 17. | **RISK PURCHASE:**<br>In case of failure to supply or comply with the terms & conditions of the purchase order, BHEL reserves the right to source such material/ component / equipment/ system or part thereof from any other agency at the risk and cost of the vendor. |
| 18. | **ADJUSTMENT OF RECOVERY:** Any amount payable by the supplier under any of the condition of this contract shall be liable to be adjusted against any amount payable to the supplier under any other works/contract awarded to him by any BHEL unit. This is without prejudice to any other action as may be deemed fit by BHEL. |
| 19. | **FORCE MAJEURE CONDITION:**<br>Force Majeure will mean: Circumstances beyond the control of contracting parties such as but not limited to act of God, natural catastrophes, fire, war, embargo, industrial dispute, riot, civil commotion, restrictions etc. Vendors willing to plead force majeure shall inform its effect on fulfillment of contract and shall not be held responsible for non performance in such circumstances. |
| 20 | **DEMURRAGE / WHARFAGE:**<br>For the reasons of delay in receipt of documents from suppliers or due to the same being found to be incomplete, and/or faulty, the suppliers shall be responsible to reimburse in all demurrages / wharfages, if any, paid by BHEL (for stated reasons). |
| 21 | **Instructions for OEM:**<br>Procurement directly from the manufacturers / suppliers shall be preferred. However, if the OEM / Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacture / supplier. Moreover, either the agent could bid on behalf of the manufacture / supplier or the manufacture / supplier could bid directly but not both. In case, bids are received from both the manufacture / supplier and the agent, bid received from the agent shall be ignored. Guarantee Certificate should be from OEM only.<br><br>However, in case of part supply or services to be done by the agent of manufacture / supplier, two separate orders can be placed by BHEL one on OEM |

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| | & other on the agent of OEM. However, System guarantee shall be provided by OEM only. |
| 22 | **Pre qualifying criteria for 220kV EHV Cable**<br><br>The bidder should have designed, manufactured, supplied, erected/supervised erection and commissioning of at least 2.0 km of 220 kV or higher grade XLPE insulated cable. In one or more installations which should be in successful operation for at least two years as on 17.09.2012.<br><br>For services, Participation by companies from China, Pakistan, Bangladesh either direct or by proxy is not acceptable.<br><br>The Bidder must ensure that they confirm the Pre qualifying criteria and the necessary documentation in this regard would be provided by Bidder to BHEL along with their offer for ascertaining that they confirm the Pre qualifying criteria. BHEL Reserves the Right to reject any offer from Bidder in case of Non – Compliance to the Pre qualifying criteria or inability of Bidder to produce the necessary documentation for ascertaining that they confirm the Pre qualifying criteria. |
| 23 | **LOADING CRITERIA FOR DEVIATIONS TAKEN BY BIDDER ON:**<br>23.1 : TERMS OF PAYMENT:<br>If a bidder asks for payment within specified no. of days from the date of receipt of invoice with complete documents as per "Terms of Payment" at sr. No. 3 above, loading to be done as follows:<br>a) Base rate of SBI (as applicable on the date of techno commercial bid opening) + 6 % shall be considered for loading for the period of relaxation sought by the bidder.<br>b) 60 days - No loading<br>23.2 : DELAYED DELIVERY / PENALITY DUE TO DELAYED DELIVERY:<br>Loading for not accepting this clause / accepting only on un delivered portion shall be the maximum amount specified in this clause. |
| 24 | **Indemnity (Against Patents / Trademarks etc) :**<br>The vendor shall at all times indemnity the purchaser against all claims which may be made in respect of the said supply from any rights protected by patent registration of design or trade mark; provided always that in the event of any claim in respect of an alleged breach of patents registered design or trademark being made against. The purchaser shall notify the seller of same and the seller shall be at liberty, but entirely at their own expenses, to conduct negotiation for settlement or deal with any litigation that may arise there from. |
| 25 | **CONVERSION TO SINGLE CURRENCY:**<br>Prices expressed in currency other than Indian Rupee will be converted to Indian Rupee at the exchange rate (TT selling rate of State Bank of India) on the due date of submission of offer for the purpose of evaluation. |
| 26 | **FINAL ENGINEERING DOCUMENTATION:**<br>Final documentation as called in the specification is to be submitted within 3 to 5 months from the date of dispatch of material at site against this contract. |
| 27 | "MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM II certificate having deemed validity (five years from the date of issue of acknowledgement in EM II) or valid NSIC certificate or |

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| | EM II certificate along with attested copy of a CA certificate (Format enclosed at Annexure -1 where deemed validity of EM II certificate of five years has expired) applicable for the relevant financial year (latest audited). Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of their bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazetted officer. " |

**Signature of Bidder** **Seal**

ANNEXURE TO NIT — A

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| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
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| | | 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. |
| | | **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 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.<br><br>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.<br><br>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.<br><br>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. |
| 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 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 |



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from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the SCC.

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 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:

(a) improper operation or maintenance of the Facilities by the Employer

(b) operation of the Facilities outside specifications provided in the Contract

(c) normal wear and tear.

27.3 The Contractor's obligations under this GCC Clause 27 shall not apply to

(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

Enclosed at 231A

(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

(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.

27.4 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.

27.5 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.

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.

| Clause No. | GENERAL CONDITIONS OF CONTRACT (GCC) |
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27.6 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.

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.

27.7 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, proceed to do such work, 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.

27.8 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 therof.

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 the 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.

# Enclosed at-2312 & 2313

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 willful 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



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| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|
| | | 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<br>(a) Reject the Equipment and recover the payments already made, or<br>(b) Terminate the Contract pursuant to GCC Sub-Clause 42.2.2 and recover the payments already made, or<br>(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 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** | 29.1 The Contractor shall, subject 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 |



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produced by the Facilities in any country.

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.

29.2 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.

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 defense of any such proceedings or claim.

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.

29.3 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.

30. **Limitation of Liability**

30.1 Except in cases of criminal negligence or willful misconduct,

(a) the Contractor shall not be liable to the Employer, 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, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer and

(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

## G. Risk Distribution

31. **Transfer of Ownership**

31.1 Ownership of the Plant and Equipment (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant and Equipment from the country of origin to that country and upon endorsement of despatch document in favour of the Employer.

31.2 Ownership of the Plant and Equipment (including spare parts) procured in the country where the Site is located 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 and upon endorsement of the despatch documents in favour of the Employer.

31.3 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.

31.4 Ownership of any Plant and Equipment in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities 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.

31.5 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.

31.6 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 Bond 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 Bond 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

| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|
| 21. | **Procurement** | 21.1 **Plant and Equipment**<br>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.<br><br>21.2 **Employer-Supplied Plant, Equipment, and Materials**<br>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:<br><br>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.<br><br>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.<br><br>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.<br><br>21.3 **Transportation**<br>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.<br><br>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.<br><br>21.3.3 Upon despatch of each shipment of the Plant and Equipment and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or Electronic Data Interchange |

| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|
| | | 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. |
| | | 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. |
| | | 33.2 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.<br><br>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 defense of any such proceedings or claim.<br><br>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. |

| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|
| | 33.3 | 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. |
| | 33.4 | 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. |
| 34. **Insurance** | 34.1 | 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. |
| | | (a) **Cargo Insurance During Transport**<br>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. |
| | | (b) **Installation All Risks Insurance**<br>Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period. |
| | | (c) **Third Party Liability Insurance**<br>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. |
| | | (d) **Automobile Liability Insurance**<br>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. |
| | | (e) **Workers' Compensation**<br>In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed. |

## Terms & Conditions of Reverse Auction

Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

2. Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder for any of the eligible items for which techno-commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.

3. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.

4. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.

5. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.

6. Bidders have to fax the Compliance form (annexure IV) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.

7. In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.

8. Reverse auction will be conducted on scheduled date & time.

9. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.

10. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure VII) as provided on case-to-case basis to Service provider within two working days of Auction without fail.

11. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL's standard practice.

12. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the 'Business Rules of Reverse Auction', which will be communicated before the Reverse Auction.

13. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines*, shall be initiated by BHEL and the results of the RA scrapped/ aborted.

14. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.

15. In case BHEL decides to go for reverse auction, the H1 bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

# BHEL UN-PRICE BID FORMAT FOR SUPPLY PORTION.

**Enquiry No: 224E197 dated 14/01/2015**
**Project: LATA TAPOVAN**
**item: 220 kV Cable & Accessories**

| S.N | PI-ITEM | Unit | Qty | Currency | Unit Ex-works/ FOB | Total Ex-works/ FOB | Unit marine freight & Insurance | Total Marine Freight & Insurance | Unit Inland F & I Charges | Total Inland F & I Charges | Excise Duty (ED) | | Central Sales Tax (CST) | | Total Cost to BHEL for indian supplier for each line item | CIF Value + Inland F & I (if opted by foreign bidder) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Instruction to bidder--------->** | | | | | | | 1. Applicable only for foreign bidder. 2. Quoted prices of marine freight & insurance is inclusive of all taxes & duties | | Quoted prices of inland freight & insurance is inclusive of all taxes & duties | | Rate of Excise Duty (in Percentage) | Amount of Excise Duty | Rate of CST (in Percentage) | Amount of CST | Bidder to indicate prices in price bid of BHEL's Format & mention QUOTED / NOT QUOTED OR NOT APPLICABLE of each & every cell | |
| **Applicable formula to bidder--------->** | | | (0) | | (1) | (2) = (1) X (0) | (3) | (4) = (3) X (0) | (5) | (6) =(5) X (0) | (7) = (.....%) | (8) = (7) x2 | (9) = (.... ...%) | (10) = ((8) + (2)) x (9) | (11) = [ (2)+ (6) + (8) + (10) ] [ EX-WORKS+ INLAND F & I + ED + CST ] | ['(12)=(2)+ (4) + (6) ] FOB+ SEA F & I + INLAND F & I ] |
| 1 | Supply item - 220kV XLPE, 1C,400 sqmm cable (14 lengths including 2 spare lengths) | M | 3500 | | | | | | | | | | | | | |
| 2 | Supply item -220kV XLPE 1C,400 sqmm Cable Complete indoor cable termination at GIS end | Nos. | 12 | | | | | | | | | | | | | |
| 3 | Supply item -220kV XLPE 1C,400 sqmm Cable Complete outdoor cable termination at Pot head yard end | Nos. | 12 | | | | | | | | | | | | | |
| 4 | Supply item -3x1-phase Earthing link box with SVL (sheath voltage limiter) including all cable/cable accessories required for the connection (1 set for 3x1-ph cable) | Set | 4 | | | | | | | | | | | | | |
| 5 | Supply item - 3x1-phase Earthing link box without SVL (sheath voltage limiter) including all cable/cable | Set | 4 | | | | | | | | | | | | | |
| 6 | Supply item - Earthing of 220 kV XLPE cable as per requirement detailed in Note.4 & 5 of clause 1.5, including earthing / bonding cable as required (1 lot is for 3 phase (2 cable runs for each phase)) | Lot | 2 | | | | | | | | | | | | | |
| 7 | Supply item - Non magnetic, Single type cleats & spacers for fixing 1 No. 220kV cable in flat formation on cable racks | Lot | 14 | | | | | | | | | | | | | |
| 8 | Supply item - Consumables having limited shelf life required during erection, testing and commissioning. (1 lot is for complete package) | Lot | 1 | | | | | | | | | | | | | |
| 9 | Supply item -Mandatory Spares - Complete indoor cable termination at GIS end | Nos. | 2 | | | | | | | | | | | | | |
| 10 | Supply item -Mandatory Spares - Complete outdoor cable termination at Pot head yard end | Nos. | 2 | | | | | | | | | | | | | |
| 11 | Supply item - Mandatory Spares - Cable straight through joints complete with all necessary fittings and installation material | Set | 2 | | | | | | | | | | | | | |
| 12 | Supply item - Mandatory Spares - 3x1-phase Earthing link box with SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | Set | 2 | | | | | | | | | | | | | |
| 13 | Supply item -Mandatory Spares - 3x1-phase Earthing link box without SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | Set | 2 | | | | | | | | | | | | | |
| 14 | Supply item -Mandatory Spares - Sheath Voltage Limiter | Nos. | 3 | | | | | | | | | | | | | |
| A | **Total Ex-works / FOB =** | | | | | | | | | | | | | | | |
| B | **Total Sea freight & Insurance =** | | | | | | | | | | | | | | | |
| C | **Total Inland freight & insurance charges =** | | | | | | | | | | | | | | | |
| D | **Total Excise Duty** | | | | | | | | | | | | | | | |
| E | **Total central sales taxes =** | | | | | | | | | | | | | | | |
| | **Total cost to BHEL for Indian supplier in Indian Currency ( A + C + D + E )=** | | | | | | | | | | | | | | | |
| | **CIF Value + Inland F & I (if opted by foreign bidder) ( A + B + C ) =** | | | | | | | | | | | | | | | |

**Note:**
**1. Each cell to be filled by bidder in the price bid. In case that cell is not applicable as per NIT condition, NA must be mentioned in UN-PRICED BID.**
**2. In UN-PRICED, Bidder to indicated QUOTED in placed of price. NA in placed of not applicable. For example Marine freight & insurance charges-Not applicable in case of indian supplier.**
**3. Bidder stickly to quote in BHEL format only. Other format of price bid will be liable for rejection.**

# BHEL UN-PRICE BID FORMAT FOR SERVICE PART

**Enquiry No: 224E197 dated 14/01/2015**
**Project: LATA TAPOVAN**
**item: 220 kV Cable & Accessories**

| S.N. | PI-ITEM | Unit | Qty | Currency | Unit Charges | Total Charges | Service taxes, if applicable in INDIA | | Total Cost to BHEL for indian supplier for each line item | Total cost to BHEL for foreign supplierfor each line item |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Instrcution to bidder--------->** | | | | | | Bidder to indicate percentage for each line item | Value | In case training / Type Test is conducted outside India, taxes outside India shall be in scope of bidder and deemed to be included in their quoted prices. | |
| | **As per BOQ for Services (Detail description as per Tech Spec.)** | | (0) | | (1) | (2) = (1) X (0) | (3) =.....% of (2) | (4) | [ '(5) =(2)+ (4) ] [ TOTAL CHARGES + SERVICE TAX ] | ['(6)=(2)+ (4) ] [ TOTAL CHARGES + SERVICE TAX ] |
| 1 | Services - Installation of 220kV XLPE, 1C,400 sqmm cable including two spare cables (14 lengths) | M | 3500 | | | | | | | |
| 2 | Services - Installation of 220kV XLPE 1C,400 sqmm Cable Complete indoor cable termination at GIS end | Nos. | 12 | | | | | | | |
| 3 | Services - Installation of 220kV XLPE 1C,400 sqmm Cable Complete outdoor cable termination at Pot head yard end | Nos. | 12 | | | | | | | |
| 4 | Services - Installation of 3-phase earthing link box with SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | Set | 4 | | | | | | | |
| 5 | Services - Installation of 3-phase earthing link box without SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | Set | 4 | | | | | | | |
| 6 | Services -Earthing of 220 kV XLPE cable as per requirement (1 lot=3 cables, 2 runns for each phase) | Lot | 2 | | | | | | | |
| 7 | Services - Installation of Non magnetic, Single type cleats for fixing 1 No. 220kV cable in flat formation on cable racks (Cable trays are not envisaged) | Lot | 14 | | | | | | | |
| 8 | Services - Training During erection/installation/site work (6 NTPC/BHEL Engineers at site -1 day) | Lot | 1 | | | | | | | |
| 9 | Services - Training during testing & commissioning at site (6 NTPC/BHEL engineers - 1 day) | Lot | 1 | | | | | | | |
| 10 | Services - Field Testing & Commissioning of 220 kV Cables | Nos. | 14 | | | | | | | |
| 11 | Services - AC Voltage Test for insulation with voltage of Uo for 24 hrs ( 1 Lot for 1 circuit) | Lot | 2 | | | | | | | |
| 12 | Services - Route Survey for laying of 220kV cable at Lata Tapovan Site | Lot | 1 | | | | | | | |
| 13 | Electrical type test on complete cable system as per IEC 62067 (Cl. 12.4) **[As per Annexure II of Tech Spc.]** | Lot | 1 | | | | | | | |
| 14 | Non Electrical type test on cable components and on complete cable as per IEC 62067 (Cl 12.5) [**As per Annexure II of Tech Spc.]** | Lot | 1 | | | | | | | |
| A | **Total Charges =** | | | | | | | | | |
| B | **Total Service Taxes =** | | | | | | | | | |
| | **Total cost to BHEL for service portion in case of Indian supplier in Indian Currency ( A + B )=** | | | | | | | | | |
| | **Total cost to BHEL for service portion in case of foreign supplier in foreign currency ( A + B ) =** | | | | | | | | | |

**Note:**
**1. Each cell to be filled by bidder in the price bid. In case that cell is not applicable as per NIT condition, NA must be mentioned in UN-PRICED BID.**
**2. In UN-PRICED, Bidder to indicated QUOTED in placed of price. NA in placed of not applicable.**
**3. Bidder stickly to quote in BHEL format only. Other format of price bid will be liable for rejection.**

TRANSMISSION BUSSINESS GROUP
MATERIAL MANGEMENT
BHEL, NOIDA

**ACTIVITY SCHEDULE**

Please submit this format duly filled in along with offer. Time indicated will be used for calculating contractual delivery period.

ENQUIRY NO. 224E197 DATE: 14/01/2015

PROJECT: LATA TAPOVAN HYDROELECTRIC

ITEM: 220 kV CABLE & ACCESSORIES

VENDOR : OFFER REF.

| SL. NO. | ACTIVITY | ACTIVITY TIME IN WEEKS | REMARKS IF ANY |
|---|---|---|---|
| 1. | Receipt of P.O | | |
| 2. | P.O Acceptance | ONE WEEK | Vendor must Submit Po acceptance with in one week |
| 3. | Submission of documents necessary for getting manufacturing clearance like Drawings, data sheet, QAP etc. | | Documents complete in all respect are to be Submitted. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier |
| 4. | Review and Approval of documents and issue of manufacturing clearance | BHEL ACTIVITY | Vendor must ensure to reply all queries expeditiously. |
| 5. | Manufacturing Time | | Manufacturing time be indicated considering all constrains & must include time required for internal inspections etc. |
| 6 | Raise inspection call | -VE 2 WEEKS TO SL NO 5 | Call for inspection must be raised at least two weeks in advance in the prescribed format. Non availability of offered material for inspection to the inspector will be viewed very seriously & may result in financial implications. The date of inspection must be with in the period indicated in 5 above. |
| 7 | Inspection | BHEL | |
| 8 | Issue of MICC, MDCC & other documents like EDEC , Road permits etc | BHEL | Vendor must indicate requirement well in advance. |
| 9 | Dispatch | ONE WEEK | Vendor must ensure to dispatch with in one Week of receiving all documents required |
| 10 | Installation Services(Laying/Erection/Testing / Commissioning | | (Please refer clause no. – 3 of terms and conditions for services portion and kindly quote accordingly for completion of service work) |

**Total time in vendor's scope:**

**Please mention constraints if any. For multiple lot delivery activity landmark for each lot should be mentioned. Multiple inspection calls for one lot are to be avoided & delay on this account shall be vendor's responsibility.**

SIGNATURE AND SEAL

ENQUIRY NO. 224E197 DATE: 14/01/2015

## CHECKLIST

### SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

**NOTE: This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.**

Put a tick mark on "YES" if the information is enclosed with the offer or put a tick mark on "NO" if the information is not enclosed or write "NOT APPLICABLE" if the information is not applicable.

| | | |
|---|---|---|
| 1. | Technical offer with detailed schedule of equipment / material and spares enclosed. | YES / NO |
| 2. | Guaranteed Technical Particulars as per Section – 4 enclosed. | YES / NO |
| 3. | Schedule of deviation, if any, clause wise with respect to Technical Specification enclosed. | YES / NO |
| 4. | Standard Manufacturing Quality Plan enclosed. | YES / NO |
| 5. | GA Drawings with dimensions and weights & foundation / fixing details enclosed. | YES / NO |
| 6. | Drawing and Data submission schedule enclosed. | YES / NO |
| 7. | Type Test Reports enclosed. | YES / NO |
| 8. | Bar Chart showing the schedule indicating time required for design, manufacture, test and inspection, transport, erection, site testing and commissioning enclosed. | YES / NO |
| 9. | Makes of all components as per technical Specification enclosed. | YES / NO |
| 10. | Schedule of commercial deviation exception from the General Terms and Conditions | YES / NO |

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal ……..

Date ……..

## SCHEDULE OF COMMERCIAL DEVIATION

The following are the deviations / variations exception from the General Terms and Conditions:-

| SL. NO. | CLAUSE NO. OF GENERAL TERMS & CONDITIONS | STATEMENT OF DEVIATION |
|---|---|---|
| | | |

Incase, this schedule is not submitted, it will be presumed that the equipment / material to be supplied under this contract is deemed to be in compliance with the General terms and Conditions.

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

NOTE: Continuation sheets of like size and format may be used as per the Bidder's requirement and shall be annexed to this schedule.

Place ……..

Date ……..

Signature of the authorized representative of

Bidder's Name …….

Designation ……..

Company seal ……

## SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations / variations exception from the Technical Specifications:-

| SL. NO. | CLAUSE NO. OF TECHNICAL SPECIFICATIONS | STATEMENT OF DEVIATION |
|---|---|---|
| | | |

Incase, this schedule is not submitted, it will be presumed that the equipment / material to be supplied under this contract is deemed to be in compliance with the Technical Specifications.

If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

NOTE: Continuation sheets of like size and format may be used as per the Bidder's requirement and shall be annexed to this schedule.

Place ……..

Date ……..

Signature of the authorized representative of

Bidder's Name …….

Designation ……..

Company seal ……

**BHARAT HEAVY ELECTRICALS LTD.**
**(TRANSMISSION BUSINESS GROUP)**

**TERMS & CONDITIONS FOR SUPERVISION / INSTALLATION SERVICES**

**NOTE:This format is to be submitted in original only, duly filled in. Reproduction of this format on bidder's letter head or on other paper is not acceptable.**

| Sl. No. | Terms & Conditions |
|---|---|
| 1.0 | **SCOPE OF WORK:** As per our attached Technical Specification No. TB-358-316-002 REV 00 |
| 2.0 | **COMMENCEMENT OF WORK**: Project start / zero date / Readiness at site for this work shall be intimated by BHEL. |
| 3.0 | **COMPLETION SCHEDULE**: Bidder to specify delivery period in weeks from the date of Project start / zero date / Readiness at site in the activity schedule format enclosed with enquiry. |
| 4.0 | **OVER RUN CHARGES**: No over run charges are payable. |
| 5.0 | **IDLE LABOUR CHARGES:** No idle labour charges will be admissible in the event of any stoppage of work resulting in the contractor's workmen being rendered idle due to any reason at any time. |
| 6.0 | **SECURITY-CUM-PERFORMANCE GUARANTEE:** The contractor shall furnish security-cum-performance BG for 10% of contract value (for Service portion) within two weeks of placement of work order valid till guarantee period from any schedule bank subject to acceptance by TBG/BHEL Finance. The original BG shall be sent by issuing bank directly to AGM - FINANCE, TBG, BHARAT HEAVY ELECTRICALS LIMITED, NOIDA.<br><br>In case BG period is expiring before expiry of Guarantee Period, vendor will have to keep the BG extended suitably till the end of Guarantee Period. |
| 7.0 | **INSURANCE:** The Contractor shall take insurance cover(s) to cover his Tools and Plant assets, workman compensation and third party liability. The contractor shall make available the original insurance cover(s) to the Engineer for necessary verification before commencement of work. |
| 8.0 | **GUARANTEE:** AS PER ATTACHED ANNEXURE TO NIT A. |
| 9.0 | **TERMS OF PAYMENT:** The terms of payment shall be as specified under Clause 3 of General Terms and Conditions of this Enquiry. |
| 10.0 | **ESCALATION / PRICE VARIATION:** Prices shall be firm for total contract period and extended period, if any, and no price escalation / price variation will be applicable. |
| 11.0 | **COMPENSATION FOR DELAY IN EXECUTION:** In case the contractor fails to complete the work within the time specified or any extension thereof subject to force major condition, the contractor shall be liable to pay by way of compensation, a sum equal to half percent (½%) of the contract price, per calendar week or part thereof by which the commissioning is delayed, subject to a ceiling of 10% of the contract price. |
| 12.0 | **ADDITIONAL EXPENDITURE:** In case any additional expenditure is incurred in the works arising out of the faulty execution of the works by the contractor, such additional expenditure shall be borne by the contractor. |
| 13.0 | **REGULATION OF LOCAL AUTHORITIES AND STATUS :** The contractor shall adhere to the regulation of local authorities and status. |
| 14.0 | **DISCIPLINE OF WORKMEN:** The contractor shall adhere to the disciplinary |

| | |
|---|---|
| | procedure set by the owner in respect of his employees and workman at site. |
| 15.0 | **FORCE MAJEURE:** The force majeure shall be as specified under Clause 19 of General Terms and Conditions of this Enquiry. |
| 16.0 | **ARBITRATION:** The arbitration shall be as specified under Clause 14 of General Terms and Conditions of this Enquiry. |
| 17.0 | **PROTECTION OF WORK:** The Contractor shall have total responsibility for protecting his works till it is finally taken over by the BHEL/Customer. No claim will be entertained by the BHEL for damage or loss to the Contractor's works & the contractor shall be responsible for the complete restoration of the damaged work to its original condition to comply with the specification & drawings. |
| 18.0 | **ELECTRICITY &WATER:**<br>Electricity for construction work shall be provided at one point on free of cost basis. The contractor shall have to make their own arrangements for distribution to various locations for their works including proper switch/fuse units, distribution boards, cables poles etc. to ensure safety of men and equipment. If required the contractor shall employ diesel operative equipment in addition to electric operated ones to ensure timely completion of work.<br>Unless stated otherwise, the contractor shall make his own adequate arrangement for procuring clear water to be used in various works. |
| 19.0 | **TESTING AND COMMISSIONING :**<br>All the electrical / mechanical test of the materials and equipment shall be arranged by the contractor as per standard specification / Field Quality Plan / Erection Manual / Directive of the Site Engineer/ and Owner. The contractor shall fill the check list for storage, erection, testing and commissioning of all their equipment as per BHEL systems to ensure proper quality of work.<br>All the testing equipment required to carry out the site test for all their equipment or the erected equipment shall be arranged by the contractor at his own cost. However, necessary instructions and guidelines will be given by BHEL/Owner.<br>The contractor shall be completely responsible for the satisfactory erection and providing test equipment and skilled manpower for testing, commissioning of all equipment.<br>Before charging, the system shall have to be approved by Statutory Govt. Authorities like Electrical Inspector, other concerned agency and the contractor has to arrange approval for the same. |

We understand that the bids having deviation (s) w.r.t tender are to be out rightly rejected. BHEL, however at their discretion, if consider the bid, have undisputable right to load the prices for price comparison as they deem fit.

Signature of Supplier with seal

# BHARAT HEAVY ELECTRICALS LIMITED
## TRANSMISSION BUSINESSS GROUP
### MATERIAL RECEIPT CERTIFICATE

Date: _____

a) Site Name :
b) Site Address:
c) PO No. with date:
d) Supplier Name:
e) Invoice no. with date:
f) LR No with date:
g) Transporter Name:
h) Vehicle No.:
i) Date of receipt of material at site:
j) Destination: From _____ To _____
k) Material details (as mentioned below):

| S.No | Item Description | Type of Packages | Unit (MT/KM/ NO.) | Qty as per packing list | Qty Received | Qty Accepted | Remarks |
|---|---|---|---|---|---|---|---|
| 1. | | | | | | | |
| 2. | | | | | | | |
| 3. | | | | | | | |
| 4. | | | | | | | |
| 5. | | | | | | | |
| 6. | | | | | | | |
| 7. | | | | | | | |
| 8. | | | | | | | |
| 9. | | | | | | | |

**Other Remarks:**

Signature with date: _____
Name & Designation: _____
(With Seal)

Attachment-D1 (6)

0135

**QUALITY CO-ORDINATION PROCEDURE**
**NAME OF PROJECT : LATA-TAPOVAN HPP**
**NAME OF PACKAGE : ELECTRO-MECHANICAL**

## 1. PURPOSE

1.1 The purpose of this document specifies the procedure to be adopted for coordination of QA & I Activities

1.2 This document is to be read in association with Engineering coordination procedure placed at Annex-II.

## 2. SCOPE

This document specifies procedure of :

- Correspondence between NTPC/NHL and Vendor
- Vendor approval
- Quality plan and field quality plant – approval/finalization
- Inspection/Testing of equipments/items
- Disposition of Non-conformities
- QA documentation Package
- Quality audit and surveillance

## 3. PROCEDURE

### 3.1 CO-ORDINATORS AND CORRESPONDENCE

3.1.1 Please Refer Engineering Coordination Procedure clause 1.0 & 2.0

3.1.2 The Correspondence concerning inspection shall be as per Clause No.3.5 described below.

### 3.2 VENDOR APPROVAL

3.2.1 List of items requiring vendor approval shall be identified in the NOA. The list contains, self manufactured items of the vendors/BHEL, the sub-vendors as proposed for bought out items (BOI's). The acceptable vendors/sub-vendors are marked 'A', sub-vendors not known to NTPC/NHL for which details are required to be submitted by as per Agreement are marked 'DR'.

3.2.2 The vendor shall ensure that all the orders for the identified BOIs are placed only on those sub-vendors approved in NOA and subsequently approved during execution of contract. Requirement of quality plan approval, NTPC/NHL inspection etc. shall be suitably tied-up with the sub-vendors in the purchase order.

3.2.3 Within 3 weeks of release of purchase order for bought out items/components, Vendor/BHEL shall furnish to NTPC/NHL a copy of the unpriced purchase order for information.

3.2.4 Vendor shall submit the complete sub-vendor details (in NTPC/NHL prescribed format placed at Annexure-Q1) for 'DR' category, if required, which will include the following :

a) Manufacturing and Testing facilities, organizational set-up and catalogues/ drawings etc., giving constructional details of the item under consideration

b) System and procedure of proposed sub-vendor followed for inspection and testing of various items covered in this scope.

c) Vendor's evaluation report in the NTPC/NHL prescribed format (Annexure-Q2) .

d) Vendor's own experience including feedback from end user if applicable for the similar size/rating/application/MOC etc. Experience details of the sub-vendor shall include date of supply/commissioning.

e) Submission of the above details shall be as per mutually agreed schedule/approved L2 and project requirements.

3.2.5 Uploading of DR related documents: NTPC/NHL shall assign a specific document no for each DR category sub vendor on receipt of written request from the vendor. The vendor shall then upload request letter and duly filled questionnaire through 'c folder' against the document number. However remaining supplementary documents shall be submitted in hard copy within three days of uploading in the system. In case further details/clarifications are required the same shall be obtained through email/discussions.

3.3 **QUALITY PLANS(QP) :**

3.3.1 Please Refer Engineering Coordination Procedure clause 3.0

3.3.2 Vendor shall submit to NTPC, the quality plans in NTPC/NHL format placed at Annexure-Q3) after ensuring compliance of technical specification requirements as a minimum and putting the signature of authorized personnel of the vendor at appropriate place on each page of the quality plans. The quality plans shall be submitted alongwith reference documents/plant standards/NDT procedures/Welding specification/Heat Treatment details /Assembly & Performance test procedures as applicable as per the agreed schedule of submission of each quality plan as per MDL.

3.3.3 Wherever Reference Quality plan/Standard Quality Plan are available, vendor shall submit endorsement sheet as per NTPC/NHL format attached at Annexure-Q4.

3.3.4 Approval of QP in Cat-I is essential for NTPC/NHL inspection, dispatch of materials and issuance of MDCC.

3.4 **FIELD QUALITY PLANS(FQP) :**

3.4.1 Please Refer Engineering Coordination Procedure clause 3.0

3.4.2 Vendor shall submit the FQP for equipment and services in NTPC/NHL format (placed at Annexure-Q5) as per agreed schedule of submission as per MDL. The FQP shall include quality practices and procedures followed by

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## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

**Approval Desired for Process/item (Rating/Size/Type) :**

1. Name of Company (Sub-Supplier):
2. Address of Regd. Office:

   _____ Tel_____

   _____ Mobile_____

   _____ e-mail_____

   _____ Fax_____

3. Address of Factory/Works

   _____ Tel_____

   _____ Mobile_____

   _____ e-mail_____

   _____ Fax_____

   **Weekly off day**

4. Branch/Liaison Office in Delhi:

   _____ Tel_____

   _____ Mobile_____

   _____ e-mail_____

   _____ Fax_____

   **Weekly off day**

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## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

5. Person(s) to be contacted

| Place | Name(s) | Official Capacity | Telephone No(s) |
|---|---|---|---|
| Regd. Off. | | | |
| Factory | | | |
| Branch/ Liaison Off. | | | |

6. Nature of Company : Proprietary/Partnership/Pvt. Ltd./Public Ltd.

**Works Details:**

7. Year of Factory Establishment :

8. Year of Commencement of Manufacture :

9. Total Area/Covered Area

10. Electric Power-Connected Load :
Electric Power-Standby Load & System

11. Finance-Total Capital :
- Annual Turnover & profit For past three years
- Limit of Credit Facility Available from the Banks :

12. Do you have in-house Department for :

a) Design Yes/No
b) Research & Development Yes/No
c) Manufacturing/Production Yes/No
d) Quality control/Inspection Yes/No
e) Clearance from pollution deptt. Yes/No

13. Shift works per day One/Two/Three

Annexure-A1 0239

## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

14. Details regarding employees :

| Division / Status | Graduate | | Diploma | Skilled | Un-Skilled | Remarks |
|---|---|---|---|---|---|---|
| | Technical | Non-Technical | | | | |
| Production | | | | | | |
| Quality Control | | | | | | |
| Admn & other Supporting Activities | | | | | | |

15. Please enclose a copy of company's organisation chart (for the unit).

16. Trade Name of Product (if any) :

17. Manufacturing capacity details :

| S. N. | Product | Licensed Capacity | Installed Capacity |
|---|---|---|---|
| | | | |

18. Brief details of items manufactured :

| Sl. No. | Item & Material | Description (Type/Size/Rating) | Annual Production for last Three years | | |
|---|---|---|---|---|---|
| | | | I | II | III |
| | | | | | |



ENGG.DIV/QA&I

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## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

19.Details of foreign collaboration, if any :

| Sl. No. | Product | Name & Address of Collaborator | Collaboration | | |
|---|---|---|---|---|---|
| | | | Scope | Year | Valid upto |
| | | | | | |

20. Have your product been type tested by any external agency? If so, give details

| Sl. No. | Product | Test (Size, Type & Class) | Test Report No. & Date | Next Due Date |
|---|---|---|---|---|
| | | | | |

21. Indicate Approval/Certification by National/International standards/agencies applicable for the subject product.

| Sl. No. | Product | Code/Standard | License No. & Date |
|---|---|---|---|
| | | | |



ENGG.DIV/QA&I

Annexure-A1 0241

## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

22. Have you been approved by any third party/statutory agency? If so, indicate details and enclose copies of approval letters.

| Sl. No. | Item/ Material | Description (Size, Type & Class) | Agency | Date of Approval | Next Due Date |
|---|---|---|---|---|---|
| | | | | | |

23. Reference list (Experience in the particular type of equipment) :

| Sl. No. | Item/ Material | Type & Capacity | Customer (End User) with Address | Date of supply | Under Operation Since Year/ Month |
|---|---|---|---|---|---|
| | | | | | |

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## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

(97)

24(a) Specific to process & product facilities :

| Sl. No. | Description of machine | Capacity & Nos. | Location Shop | Make | Year of Manufg. |
|---|---|---|---|---|---|
| | | | | | |

(98)

## SUB-SUPPLIER QUESTIONNAIRE
(To be filled in by the Sub Supplier)

24(b) Other/General facilities :

| Sl. No. | Description of machine | Capacity & Nos. | Location Shop | Make | Year of Mfg. |
|---|---|---|---|---|---|
| 1) | Material Handling<br>Mobile Crane<br>Fork Lift<br>Over Head Cranes | | | | |
| 2) | Metal Cutting &<br>Bending | | | | |
| 3) | Casting | | | | |
| 4) | Forging | | | | |
| 5) | Fabrication | | | | |
| 6) | Welding | | | | |
| 7) | Machining | | | | |
| 8) | Heat Treatment | | | | |
| 9) | Sheet Metal | | | | |
| 10) | Fettling & Cleaning<br>Sand Blasting<br>Shot Blasting<br>Pickling | | | | |
| 11) | Painting | | | | |
| 12) | Metal Coating | | | | |
| 13) | Protection before packing | | | | |
| 14) | Packing | | | | |
| 15 | Other | | | | |
| | | | | | |

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## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

(99)

25 (a) Facilities for Testing & Inspection :

| Sl. No. | Description | Capacity & Nos. | Make & year of Mfg. | Calibration Status | Approval Qualification | |
|---|---|---|---|---|---|---|
| | | | | | | |

25 (b) If In-house testing facilities are not available, indicate source of testing with relevant details:

| **Sl. No.** | **Source of Testing** | **Description** | **Capacity & Nos.** | Make & year of Mfg. | Calibration Status | **Approval/ Qualification** | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

26 (a) Details of any Govt. laboratory facilities available in area :

26 (b) Product related testing facilities (Type/Performance/Routine/Acceptance Tests)

26 (c) Storage of finish goods (covered / open)

एनटीपीसी NTPC

## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

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27 Source of Raw Materials (including imported raw materials) :

a) Type Source

b) Raw material storage & identification :

28. **No. of PCs available with internet Connectivity at works:**

## 29. Quality management

### 29.1 General

29.1.1. Organisation Chart of Quality Management: Attached: (Y/N)

29.1.2. Head of QC Department reports to :

29.1.3. Do you have a written Quality Control Instruction Manual? If yes, please furnish a copy of the same.

29.1.4. Have written Quality Control Instruction sheets been prepared and properly used ?

29.1.5. Are records generated during inspection maintained & available for review?

29.1.6. Are final inspection areas clean, adequately lighted & of suitable size?

29.1.7. Are written procedure defining stage wise operations and functions on shop floor established and followed?

29.1.8. Are quality control checks adequate to maintain desired quality right from incoming stage to final operation?

29.1.9. Whether 100% or adequate sampling inspection used?

29.1.10. Are statistical quality control techniques used?

### 29.2. Corrective Action

29.2.1. Does the system provide for proper detection of inferior quality and correction of its assignable causes?

29.2.2. Is adequate action taken to correct the causes of defects in products?

**29.2.3.** Are analysis made to identify trends towards product deficiencies?

**29.2.4.** Does corrective action extend to products?

## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

(101)

**29.3 Documentation Control**

29.3.1. Does a system for clear and precise stipulation of responsibilities for documentation issue & change control exists?

29.3.2. Are changes made in writing?

**29.4. Control of Inspection, measuring & Testing equipments**

29.4.1. Are necessary gauges, testing and measuring equipment's, available and used?

29.4.2. Are testing and measuring equipment properly maintained?

29.4.3. Is recorded control on calibration of equipment available?

**29.5. Control of procured supplies & Services**

29.5.1. Do the vendor/sub-Supplier's purchasing documents refer to specific design manufacturing and testing requirements?

29.5.2. Do purchasing documents also contain special requirements?

29.5.3. Are requirements for necessary tests and inspection of raw material specified in purchasing documents?

**30. CONSISTENCY IN SUPPLY**

30.1. Has the vendor/sub-Supplier produced items of similar nature in past?

30.2. Has the vendor/sub-Supplier maintained delivery commitments in past?

30.3. Has there been frequent labour trouble in past?

30.4. Has there been major upset due to faulty material management?

30.5 Whether the system of planning and scheduling resilient enough to overcome temporary setbacks and make up lost time?

30.6. Can the vendor/sub-Supplier quickly off load the work to other reliable subvendors:

If Yes, the name of sub-vendors :

31. Order booking position as on date in terms of:

a) Value :

b) Time :

32. Any special information

(194)

(162)

## SUB-SUPPLIER QUESTIONNAIRE
**(To be filled in by the Sub Supplier )**

33. I CERTIFY THAT THE INFORMATION SUPPLIED HEREIN (INCLUDING ALL PAGES ATTACHED) IS CORRECT TO THE BEST OF MY KNOWLEDGE.

SEAL

**SIGNATURE**_____
**NAME**_____
**DESIGNATION**_____
**M/S.**_____
**PLACE**_____
**DATE**_____

LIST OF ENCLOSURE

1.
2.
3.

**Certification by Main Supplier:** Above information have been verified and found in order / minor changes which have been marked and initialed on this form itself / observed the following discrepancies.

Name : Designation : Signature : Date :

**Certification by visiting team :** Above information except as under have been verified and found in order.

Name : Designation : Signature : Date :

1.
2

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Annexure-A2

(103)

# MAIN SUPPLIES'S EVALUATION REPORT
(For Proposed Sub-Supplier)

0248

MAIN SUPPLIER M/S.....

PACKAGE & PROJECT :

EQUIPMENT / ITEM :

GENERAL INFORMATION

1. PROPOSED SUB-SUPPLIER'S NAME & WORKS ADDRESS :

2. CONTACT PERSON :
   TELEPHONE (LAND LINE/MOB.) :
   FAX :
   E-MAIL :

3. BRIEF SPEC. OF EQUIPMENT ITEM/MODEL/TYPE /RANGE / CAPACITY:

4. REFERENCE LIST (EXTENSIVE EXPERIENCE IN THE PARTICULAR TYPE OF EQUIPMENT / ITEM)

| CUSTOMER/ LOCATION WITH ADDRESS AND CONTACT PERSON | TYPE , RATING & CAPACITY | DATE OF COMMISS-IONING. | NO. OF YRS. IN OPERA-TION | PERFORMANCE FEEDBACK |
|---|---|---|---|---|
| | | | | |

5. RECOMMENDATIONS :

NAME_____ DESIGN_____ SIGN.:_____

List of Encl.

Date :_____

Annexure - I

## Certificate by Chartered Accountant on letter head

This is to Certify that M/S ....., (hereinafter referred to as 'company') having its registered office at ..... is registered under MSMED Act 2006, (Entrepreneur Memorandum No (Part–II) ..... dtd:....., Category: ..... (Micro/Small)). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as per the latest audited financial year ..... as per MSMED Act 2006 is as follows:

1. **For Manufacturing Enterprises:** Investment in plant and machinery (i.e. original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No.S.O.1722(E) dated October 5, 2006 :
   Rs.....Lacs
2. **For Service Enterprises:** Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:
   Rs.....Lacs

**(Strike off whichever is not applicable)**

The above investment of Rs.....Lacs is within permissible limit of Rs.....Lacs for .....Micro / Small **(Strike off which is not applicable)** Category under MSMED Act 2006.

Or

The company has been graduated from its original category (Micro/ Small) **(Strike off which is not applicable)** and the date of graduation of such enterprise from its original category is ..... (dd/mm/yyyy) which is within the period of 3 years from the date of graduation of such enterprise from its original category as notified vide S.O. No. 3322(E) dated 01.11.2013 published in the gazette notification dated 04.11.2013 by Ministry of MSME.

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant

# INSPECTION REQUEST

1. Name & Address of Supplier :
2. Project :
3. Purchase Order No., Revision No. & Date :
4. Details of equipment / Material to be Inspected

| Sl. No. | Material offered for Inspection | P.O. Item No. | Total Quantity Ordered | Quantity offered for Inspection | Quantity Already Cleared | P.O. value of offered qty. |
|---|---|---|---|---|---|---|
| | | | | | | |

5. For structure, whether BOM & Proto Corrected Drawings approved and available at place of inspection : Yes / No
6. Whether GTP/Drgs approved in Category – 1 available at place of inspection : Yes / No
7. Whether Quality Plan approved in Category – 1 available at place of inspection : Yes / No.
8. Whether all type tests approved by Engineering :Yes / No
9. (a) Place of Inspection & Address :
9. (b) Name & contact No. of Supplier rep. for inspection :
10. Sub – supplier contact person's name & contact No. :
11. Weekly off day :
12. Working Hours :
13. Date on which inspection requested (Inspection call to be raised at least 7 days prior to inspection) :
14. No of road permits required :

It is certified that the above materials shall be completed in all respects and shall have been inspected by us before the date indicated above for inspection. You are requested to please depute your representative for inspection

Signature
Name :
Contact No. :
Date :

Distribution :

1. Material Management , BHEL, New Delhi

Note :

1. Unsigned inspection request & Inspection requests not given in this format are not accepted.
2. Drawings, Quality Plan should be approved in category – I by BHEL Transmission Business Engineering Management before the inspection date. In case inspection request is given without Category – I approved documents, supplier should be obtain from BHEL Transmission Business Engineering Management in writing to this effect and attach to inspection request.

(ON RS.100/- NON - JUDICIAL STAMP PAPER)

## PROFORMA FOR SECURITY-CUM-PERFORMANCE GUARANTEE

1. This deed of Guarantee made this _____day of _____200 ___ by _____Bank Ltd., _____in favour of **Bharat Heavy Electricals Limited, Transmission Business Group, Tower-A, 5th Floor, Advant Navis IT Business Park, Plot-7, Sector-142, Expressway Noida, Noida-201305** having their registered office at **BHEL House, Siri Fort, New Delhi - 110 049.**

2. Whereas **M/s** _____( here in after called the **Contractor** / **Seller** ) have entered into a Contract bearing No. _____ dated _____(herein after called the **Contract** ) for supply / erection of **M/s Bharat Heavy Electricals Limited** ( hereinafter called the **Company** ).

3. And whereas the said Contract Inter-alia provides that the Contractor / Seller shall pay to the company a sum of Rs. _____only, towards **Security deposit-Cum-Performance Guarantee** in the for and manner therein specified.

4. And whereas the Seller/Contractor have approached _____ Bank Limited (hereinafter referred to as the **Guarantor**) and at their request and in consideration of the arrangement arrived at between the **Contractor** and the **Guarantor**, the Guarantor has agreed to give the Guarantee as herein after mentioned in favour of the Company.

**NOW THIS DEED WITNESSES AS FOLLOWS :**

5. The Guarantor by the hand of Mr. _____ and its lawfully and fully constituted attorney and do hereby guarantee the due and faithful performance of the said contract and do hereby irrevocably undertake and promise to pay the Company without any demur merely on demand made by them a sum not exceeding Rs. _____ only in case the Company sustains any loss or damage by reason of any breach, default, by the Contractor / Seller of any of the terms conditions, stipulations or undertakings or any one of them contained in the said contract and the tender documents attached hereto and for payment of any moneys payable by the Contractor/ Seller to the Company under the terms and conditions of the said contract. The decision of the company regarding the breach, default, loss, damage or payment shall be conclusive and binding in the guarantor irrespective of the fact whether the contractor/seller admits or denies such claims or questions its correctness in any court, tribunal or arbitration proceedings or before any other authority.

(Contd....2.)

6. The company shall have the fullest liberty without effecting in any way the liability of the Guarantor under this Guarantee, from time to time to vary any of the terms and conditions of the contract or extend time by the Seller/Contractor or to postpone for any time and from time to time any of the powers exercisable by its against the Seller/Contractor and either to enforce or forbear from enforcing any of terms and conditions governing the contract or securities available to the Company and the guarantor shall not be released from it's liability under these presents by any exercise by the company of the liberty with reference to the matters aforesaid or by reason of time being given to the seller or any other forbearance, act or omission on the part of the company or any induigence by the company to the Seller/Contractor or of any other matter or thing whatsoever which under the law relating to sureties, would but for this provision have the effect of so releasing the Guarantor/contractor from its liability under this Guarantee.

7. This Guarantee shall remain in full force and effect and the Guarantor shall be liable under the same irrespective of any concession or time being granted by the company to the contractor in or for fulfilling the said contract and this Guarantee shall remain in full force irrespective of any change in terms, conditions, stipulations or any variations in the terms of contract irrespective of whether notice of such change and / or variation is given to the Guarantor or not and the claim to receive such notice of any change and or variation of the terms/or conditions of the contract is hereby specifically waived by the Guarantor.

8. The Guarantor here in contained shall not be determined prejudiced or effected by the liquidation or winding up or insolvency of or change in the constitution of the contractor but shall in all respects and for all purposes be binding and operative until all payments or all moneys due or that may hereafter become payable to the company are paid in respect of any liability or obligation of the contractor under the contract.

9. The Guarantor further agree that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the commencement of the contract till end of the contract and its claim satisfied or discharged and till the company certified that the terms and conditions of the contract have been fully and properly carried out by the seller and accordingly discharges this Guarantee, subject, however, that the company shall have no claim under this guarantee after _____ months from the date of completion of the guarantee has been served on the guarantor before the expiry of the said period in which case the same shall be enforceable against the Guarantor not with standing the fact that the same is enforced after expiry of said period.

   The Guarantor undertake not to revote this Guarantee during the period it is in force except with the precious consent of the company in writing and agree that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the Seller or the guarantor shall not discharge the Guarantor's liability here under.

It shall not be necessary for the company to proceed against the seller before proceeding against the Guarantor and the Guarantee herein contained shall be enforceable against them not with standing any security which the company may have obtained or obtained from the seller shall at the time when proceedings are taken against the Guarantor here under be outstanding or unrealised.

The Guarantor hereby declares that it has power to execute this Guarantee and the executant has full powers to do so on its behalf under the power of attorney dated _____granted to him by the proper authorities of the Guarantor.

10. Not withstanding anything here in before contained, our liability under this Guarantee is restricted to Rs. _____(Rs._____only) and will expire on _____ and unless a claim in writing is presented to us or an action or suit to enforce the claim is filed against us, within ***three months*** from the date, all our rights shall be forfeited and we shall be relieved and discharged from all our liabilities there under.

IN WITNESS whereof the _____(Bank) have hereunto set and subscribed their hands the day, month and year first above written.

**SIGNED FOR AND ON**
**BEHALF OF THE BANK**

**WITNESSESS**

**Name and Address** **Signature**

**1.** **……**
**……**
**……**
**……**
**……**

**2.** **……**
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**……**
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**……**

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|---|---|---|
| IS 2175 | : | Heat sensitive fire detectors for use in automatic fire alarm system. |
| IS 2148 | : | Electrical apparatus for explosive gas atmospheres-flameproof enclosures "d". |
| IS 694 | : | PVC insulated cables for working voltages upto and including 1100 volts – Specification. |
| IS 4237 | : | General requirement for switchgear & control gear. |

**Water Based Fire Protection System.**

| | | |
|---|---|---|
| NPFA 13 | : | Installation of sprinkler systems |
| NFPA 14 | : | Installation of standpipe and hose systems |
| NFPA 15 | : | Water spray fixed system |
| NFPA 25 | : | Fire Pumps & Controllers |
| TAC doc. | : | Recommendation for fire protection of transformers |
| IS 3034: 1993 | : | Fire safety of industrial buildings: Electrical generating & distributing stations - Code of practice. |
| IS 10221 | : | Code of Practice for Coating and Wrapping of underground mild steel pipelines. |
| IS 952 | : | Specification for Fog nozzles for fire brigade use |
| IS-8034 | : | Specification for submersible pump sets. |
| IS 3844 | : | Code of practice for installation & maintenance of internal fire hydrants hose reels on premises. |
| IS 780 | : | Sluice valves for water work purposes |

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|---|---|---|---|
| | IS 5312 | : | Swing check type reflux (non return) valve for water works purposes- Specification. |
| | IS 903 | : | Fire hose delivery couplings, branch pipes, nozzles and spanner – Specification. |
| | IS 9972 | : | Specification for Automatic sprinkler heads for Fire protection system. |
| | IS 7760 | : | Specification for steel glass front cabinets. |
| | IS 901 | : | Specification for couplings double male and double Female instantaneous pattern for fire fighting. |
| | IS 5290 | : | Landing valves – Specification. |
| | IS 4927 | : | Unlined flax canvas hose for fire Fighting – Specification. |
| | IS 884 | : | Specification for first aid hose reel for fire fighting. |
| | **Portable Fire Extinguishers** | | |
| | NFPA 10 | : | Portable fire extinguishers |
| | IS 2190 | : | Selection, Installation & Maintenance of first aid fire extinguishers - Code of practice. |
| | IS 2171 | : | Portable Fire Extinguishers, dry powder (cartridge type) - Specification |
| | IS 2878 | : | Fire extinguisher, Carbon dioxide type (portable and trolley mounted) – Specification. |
| | IS 933 | : | Specification for Portable Fire extinguisher Foam Type. |
| | IS 13849 | : | Portable fire extinguisher Dry powder Type (Stored Pressure)- Specification |

IS 940 : Portable fire extinguisher, water type (gas cartridge) - Specification

NFPA 2001 : Standard on clean agent fire extinguishing system

**VENTILATION AND AIR CONDITIONING SYSTEM**

| Standard | Title |
|---|---|
| IS 4720 | Code of practice for ventilation of surface hydel power station |
| IS 3103 | Code of practice of ventilation for industrial ventilation |
| IS 4894 | Centrifugal fans |
| IS 2312 | Propeller type AC ventilating fans |
| IS : 7613 | Air filters |
| DIN-2425 | Pumps and motors |
| BS 2831 | Methods of test for air filters used in air conditioning and general ventilation |
| BS 3928 | Sodium flame test for air filters other than for air supply to I.C Engines and Compressors. |
| IS 655 | Metal Air Ducts |
| IS 277 | Specification for Galvanised Steel Sheets |
| IS 737 | Specification for Wrought Aluminium or Aluminium Alloys Sheet and Strip |
| IS : 3624 | Pressure & vacuum gauges |
| IS 659 | Safety code for Air conditioning |
| IS 5111 | Measurement of testing refrigerant compressor |
| IS 3069 | Glossary of terms, symbols and units relating to thermal insulation material |
| IS 4671 | Expanded polystyrene for thermal insulation purpose |
| ARI Standard | Sound level measurement |

| | |
|---|---|
| 575-87 | |
| ASTM B-88 | Refrigerant piping |
| IS : 702 | Hot Bitumen Insulation |
| IS : 1042 | Code for flow measurement |
| ASHRAE15-1994 | Safety code for Mechanical Refrigeration |
| IS : 661 | Code of practice for insulation |
| IS : 14164 | Mode of Measurement of insulation |

**ELECTRIC PASSENGER LIFT**

| | |
|---|---|
| IS-4289 | Flexible cables for lifts and other flexible connections. |
| IS-14665, Part-1,2,3&4 | Electric Traction lift. |

**GENERAL**

| | | |
|---|---|---|
| IS:800 | Code of practice for use of structural steel in general building construction | BS 449:1969<br>BS 5950<br>ASA A57, 1-1952 |
| IS:807 | Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists | Draft Revision of A.S. NO. CS.2 SAA Crane and Hoist code Doc:No. BU/4 Rev 6588 (Issued by Standards Association of Australia).<br>DIN 120:1936 (Sheet 1)<br>DIN 120:1936 (Sheet 2)<br>327 part-I, 1951<br>BS 466 part-II, 1960<br>BS 644:1960<br>BS 1757:1951<br>BS 2573:part-I:1960 |
| IS:875 | Code of practice for design loads (other than earthquake) for buildings and structures | National Building code of Canada (1953)-Part-IV |
| | Leading standards | Design section 4.1 |

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|---|---|---|---|
| | | | (issued by Canadian Standard)<br>DIN-1055-1955<br>(Issued by ASA) |
| | IS:1239<br>Part-I | Mild steel tubes | (ISO/R 65-1957)<br>(ISO/R-64-1958)<br>(ISO/R-65-1958)<br>(BS 1387 : 1957) |
| | IS:1239<br>Part-II | Mild steel tubulars and other wrought steel pipe fittings | BS 1387 : 1967<br>BS 1387 :1967<br>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 | API Standards 5L<br>April 1969. |
| | IS:2254-1970 | Dimensions of vertical shaft motor for pumps | IEC Pub 72-1 part I<br>NEMA Pub MG 1<br>1954 |
| | IS:2312 | Propellant type Ventilation fans | |
| | IS:3346 | Method for the determin-ation of thermal conductivity of thermal insulation materials (two slab guarded hot plate method) | DIN 52612 (Deutscher Normenausschuss)<br>ASTM C 163-1964 (American Society of Testing and materials)<br>ASTM C 167-1974<br>ASTM C 177-1963 |

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|---|---|---|---|
| | 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 monocry-stallines 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 monory-stallines rectifire assembly equipment | |
| | IS:4671 | Expanded polystyrene for thermal insulation purpose | |
| | IS:4736 | Hot dip zinc coating on steel tubes | |
| | 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<br>Entwurf DIN 15402<br>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-Acceplance test | |
| ASHRAE-33 | Methods of testing for rating of forced circulation air cooling and air heating coils. | |
| ASHRAE-52-76 | Air cleaning device used in general ventilation for removing particle matter. | |
| ASHRAE-22-72 | Method of testing for rating of water cooled refrigerant condensers. | |
| ASHRAE 23-67 | Methods of testing for rating of positive displacement refrigerant compressors. | |
| ARI-450-6 | Standard for water cooled refrigerant condensers. | |
| 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. | |

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| 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 refinary 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.

**Properties, Storage and Handling of Common Building Materials**

| | |
|---|---|
| IS: 808 | Rolled steel Beam channel and angle sections. |
| 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: 2062 | Specification for steel for general structural purposes. |
| IS: 8500 | Medium and high strength structural steel. |

**Sheeting Works**

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| IS:277 | Galvanised steel sheets (plain or corrugated). |
| IS: 459 | Unreinforced corrugated and semi-corrugated asbestos cement sheets. |

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| | 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. |
| | 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. |

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| 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. |
| 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 ISI (Part 1 to 7) | 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. |

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| | IS : 3658 | Code of practice for Liquid penetrant Flaw Detection. |
| | IS : 5334 | Code of practice for Magnetic Particle Flaw Detection of Welds. |
| | **Water Supply, Drainage and Sanitation** | |
| | IS : 458 | Specification for concrete pipes. |
| | 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 : 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. |

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| IS : 1879 | Malleable cast iron pipe fittings. |
| IS : 2064 | Code of practice for selection, installation and maintenance of sanitary appliances. |
| IS : 2065 | Code of practice for water supply in building. |
| IS : 2326 | Automatic flushing cisterns for urinals. |
| IS : 2470 | Code of practice for installation of septic tanks. |
| (Part-I & II) | |
| IS : 2501 | Copper tubes for general engineering purposes. |
| IS : 2548 | Plastic seat and cover for water-closets. |
| IS : 2556 | Vitreous sanitary appliances (vitreous china). |
| (Part 1 to 15) | |
| 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 | Code of practice for ancillary structure in sewerage system. |
| (Part I to IV) | |
| 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. |

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| | 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. |
| | 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. |
| | **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. |
| | 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. |

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|---|---|---|
| | 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. |
| | ISO : 8501-1 | Sand blasting. |
| | ISO:8601-1 | Surface preparation of steel or ferrous equipment. |
| | 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. |
| | **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. |
| | 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 Publication | Design and construction of buried thin-wall pipes. |

## 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.
3. Compatibility 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.

**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. Instrinsically 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.

**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

**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.
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 socket weld 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 - ASTMD - 2843.

11. Acid gas generation test - IEC - 754 - 1.

12. Swedish Chimney test - SEN - 4241475 (F3).

13. Teflon (FEP) insulation & sheath test - ASTMD - 2116.

14. Thermocouple compensating cables - Testing requirements & sampling plan IS: 8784.

15. PVC insulated electric cables for working voltage unto and including 1100 V - IS: 1554 (Part-I).

**Cable Trays, Conduits**

1. Guide for design and installation of cable systems in power generating staiton (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 - ASTMA - 386-78.

**Public Address System**

1. Specifications for lod 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-II**

**NUMBER OF COPIES OF DRAWING AND DOCUMENTS**

| Sl. No. | DESCRIPTION | NO. OF PRINTS | NO. OF CD-ROMs/Soft Copies | NO. OF MANUALS (SETS) |
|---|---|---|---|---|
| 1. | PLANT DEFINITION MANUAL | - | 3 CD-ROMs | 10 |
| 2. | Drawings "FOR APPROVAL" | 6 | 1 CD-ROM or Soft Copies by E-Mail | - |
| 3. | Drawings "FOR INFORMATION" | 4 | 1 CD-ROM or Soft Copies by E-Mail | - |
| 4. | Drawings "FINAL DRAWING" | 10 | 3 CD-ROMs | - |
| 5. | Drawings "AS BUILT" | 10 | 3 CD-ROMs | - |
| 6. | DATA SHEETS, DESIGN CALCULATIONS, PURCHASE SPECIFICATIONS, etc. and Other type of documents. | | | |
| | i) For Approval | 4 | 3 CD-ROMs/Soft Copies by E-Mail | - |
| | ii) FINAL | 10 | 3 CD-ROMs | - |
| | iii) Analysis reports of equipments / structures components / systems employing software packages as detailed in the specifications | | | |
| | a) Input | 4 | 3CD-ROMs | - |
| | b) Output | 4 | 3CD-ROMs | - |
| | c) Drawings / Sketches | 4 | 3CD-ROMs | - |

| Sl. No. | DESCRIPTION | NO. OF PRINTS | NO. OF CD-ROMs/Soft Copies | NO. OF MANUALS (SETS) |
|---|---|---|---|---|
| 7. | Erection manual "DRAFT" | - | 1 CD-ROM or Soft Copies by E-Mail | 4 |
| 8. | Erection manual "FINAL" | - | 3CD-ROMs | 10 |
| 9. | Operation & Maintenance manual "DRAFT" | 1 | 1 CD-ROM or Soft Copies by E-Mail | 4 |
| 10. | Operation & Maintenance manual "FINAL" | - | 3CD-ROMs | 10 |
| 11. | Plant Hand Book "DRAFT" | 1 | 1 CD-ROM or Soft Copies by E-Mail | 4 |
| 12. | Plant Hand Book "FINAL" | 3 | 3 CD-ROMs | 10 |
| 13. | Commissioning and Performance Procedure manual "DRAFT" | 1 | 3 CD-ROMs/Soft Copies by E-Mail | 4 |
| 14. | Commissioning and Performance Procedure manual "FINAL" | 1 | 3 CD-ROMs | 10 |
| 15. | Performance and Functional Guarantees test report | 8 | 3 CD-ROMs | |
| 16. | Progress Reports | 8 | 3 CD-ROMs/Soft Copies by E-Mail | |
| 17. | Project completion report | 15 | 3 CD-ROMs | - |
| 18. | QA programme including Organisation for implementation and QA system manual (with revision servicing) | 15 | 3 CD-ROMs | - |
| 19. | Vendor details in respect of proposed vendors, including Contractor's evaluation report. | 1 | - | - |

| Sl. No. | DESCRIPTION | NO. OF PRINTS | NO. OF CD-ROMs/Soft Copies | NO. OF MANUALS (SETS) |
|---|---|---|---|---|
| 20. | Manufacturing QP's, Field QPs, Field welding schedules and their reference documents like test procedures, WPS, POR etc. | | | |
| | i) For review / comment | 3 | - | - |
| | ii) For final approval | 4 | 1 CD-ROM | |
| 21. | Welding Manual, Heat Treatment Manuals, Storage & preservation manuals | | | |
| | i) Draft | - | - | 4 sets |
| | ii) Final | - | 2 CD-ROMs | 4 sets |
| 22. | Monthly Vendor Approval and QP approval status | 2 | 1 CD-ROM or Soft Copies by E-Mail | |
| 23. | QA Documentation package for items / equipment manufactured and despatched to site. | 2 | 2 CD-ROMs | |
| 24. | QA Documentation Package for field activities on equipment / system at site. | 2 | 2 CD-ROMs | |

ANNEXURE-III

**1.00 EQUIPMENTS**

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| | **TG SET** | | | | | | |
| 1. | Turbine | Blue | 5012 | White | | 9010 | Legend in black letters |
| 2. | Main generator | Blue | 5012 | White | | 9010 | Legend in black letters |
| 3. | **Pumps** | | | | | | |
| | Lube oil | Grey | 9002 | White | | 9010 | Legend in black letters |
| 4. | Valves, gates, filters | Grey | 9002 | White | | 9010 | Legend in black letters |
| 5. | Turbine Oil System | Grey | 9002 | White | | 9010 | Legend in black letters |
| 6. | Hand rails | Blue | 5012 | | | | Wherever required otherwise SS or GI |
| 7. | Pipe supports | Black | 9011 | | | | |
| 8. | Gratings (non-galvanised) | Black | 9011 | | | | |
| 9. | Air ducts | Grey | 9002 | White | | 9010 | Legend in |

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| | | | | | | | black letters. |
| 10. | FANS | Grey | 9002 | White | | 9010 | Legend in Black Letters. |
| 11. | Structural steel work fabricated at site | Grey | 9002 | | | | |
| | **HP AND LP COMPRESSED AIR SYSTEM** | | | | | | |
| 12. | Compressors with inter and after coolers | Blue | 5012 | White | | 9010 | Identifying legends to be used. |
| 13. | Heater/Drivers | Grey | 9002 | White | | 9010 | - |
| 14. | Air receivers | Blue | 5012 | White | | 9010 | Legend in black letters |
| | **MISCELLANEOUS EQUIPMENTS** | | | | | | |
| 15. | Cranes | Golden Yellow | 1004 | White | | 9010 | |
| | - Mono Rails & chain pulley systems | Golden Yellow | 1004 | | | | |
| 16. | Hooks | Signal Red | 3001 | | | | |
| 17. | Tanks | Grey | 9002 | white | | | Legend in Black letters |

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| 18. | Doors industrial type | Blue | 5012 | | | | |
| 19. | Hydraulic power unit | Golden Yellow | 1004 | Signal Red | 537 | 3001 | |
| 20. | Fencing | Black | | | | | |
| 21. | Lighting poles | Aluminium | | | | | |
| | **ELECTRICAL COMPONENTS** | | | | | | |
| 22. | **MAIN GENERATOR** | | | | | | |
| | - Lub oil system<br>- Seal Oil System | Grey | 9002 | White | | 9010 | Legend in Black Letters |
| | - Stator Water Sys. | Grey | 9002 | White | | 9010 | Legend in Black Letters |
| 23. | **DIESEL GENERATOR SET** | | | | | | |
| | - Diesel Engine | Grey | 9002 | White | | 9010 | |
| | - Generator | Grey | 9002 | White | | 9010 | |
| 24. | **L.T. TRANSFORMERS** | | | | | | |
| | - Indoor | Blue | 5012 | | | | Legend in Black Letters |

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| | - Outdoor | Blue | 5012 | | | | Legend in Black Letters |
| 25. | 33 KV class transformers | Blue | 5012 | Signal Red | 537 | 3001 | |
| 26 | Generator bus duct | Blue | 5012 | Signal Red | 537 | 3001 | |
| 27. | Battery charger | Grey | 9002 | White | | 9010 | |
| 28. | Mimic flow diagram | | | | | | |
| | 220 KV | Purple Violet | 4007 | White | | 9010 | |
| | 33.0 KV | Olive Green | 6003 | White | | 9010 | |
| | 11.0 KV | Zink Gleb | 1018 | White | | 9010 | |
| | 415 V | Lehm Braun | 8003 | White | | 9010 | |
| | 220V DC | Tief Orange | 2011 | | | | |
| | Gen Fld. | Tiefschwartz | 9005 | | | | |
| 29. | **MOTORS** | | | | | | |
| | - Indoor | Blue | 5012 | | | | |
| | - Outdoor | Blue | 5012 | | | | |

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| 30. | **LT SWITCHGEAR (INDOOR)** | | | | | | |
| | - LT Switchgear Exterior | Grey & Blue | 9002 5012 | | | | Front & Rear Panels in Grey (RAL 9002). End Panels sides in Blue (RAL 5012) |
| | - MCC | Grey & Blue | 9002 5012 | | | | Front & Rear Panels in Grey (RAL 9002). End Panels sides in Blue (RAL 5012) |
| | - D.C. Distributio n board | Grey & Blue | 9002 5012 | | | | Front & Rear Panels in Grey (RAL 9002). End Panels sides in Blue (RAL 5012) |
| | L.T. busduct outside of enclosures | Blue | 5012 | | | | |

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| 31. | **33 KV SWGR cubicle** | Grey & Blue | 9002 5012 | | | | Front & Rear Panels in Grey (RAL 9002). End Panels sides in Blue (RAL 5012) |
| | - CR Panels | Grey | 9002 | | | | |
| | - Surge protection cubicle | Grey | 9002 | | | | |
| 32. | DDCMIS/PLC system cabinets, computer system cabinets, Termination, Marshalling, Relay Panels etc. | Blue & Grey | 5012& 9002 | | | | Front & Rear Panels in Grey (RAL 9002). End Panels sides in Blue (RAL 5012) |
| 33. | All locally mounted C&I systems panel/ cabinets | Blue & Grey | 5012& 9002 | | | | Front & Rear Panels in Grey (RAL 9002). End Panels sides in Blue (RAL 5012) |
| 34 | Junction boxes | Grey | 9002 | | | | |
| 35 | LIE/LIR | Grey | 9002 | | | | |

| | | GROUND COLOUR | | IDENTIFICATION TAG/BAND | | | |
|---|---|---|---|---|---|---|---|
| ***Sl. No.*** | ***Equipment*** | ***Colour*** | ***RAL*** | ***Colour*** | ***ISC No.*** | ***Equi-valent RAL No.*** | ***Remarks*** |
| 36 | Remote I/O cabinets | Grey | 9002 | | | | |
| 37 | Intercom | Equipme nt | | | | | |
| | - Hand sets unit | Grey | 9002 | | | | |
| | - Hand sets plant | Grey | 9002 | | | | |
| 38 | - Metal containers/ cable junction boxes | Grey | 9002 | White | | 9010 | - |
| 39. | **LIGHTING EQUIPMENT/PANELS** | | | | | | |
| | - Exterior | Grey | 9002 | | | | |
| 40. | **INSULATING OIL TREATMENT PLANT** | | | | | | |
| | - Tanks and the equipment | Grey | 9002 | White | | 9010 | Legend in Black Letters |
| 41. | **IDENTIFICATIONS PLATES** | | | | | | |
| | Mechanical equipment's and piping | | | | | | |
| | - Background | White | 9010 | | | | |
| | - Border | Black | 9011 | | | | |
| | - Lettering | Black | 9011 | | | | |

Note: 1) For mechanical equipments ground colour indicated against each equipment shall be followed in case equipment is not insulated/cladded.

2) However if enclosure is provided for the mechanical equipments, then the indicated ground colour for mechanical equipment shall be followed

**2.00 PIPELINES**

| | | *Ground Colour* | | *Identification Tag/ Band Colour* | | | | |
|---|---|---|---|---|---|---|---|---|
| ***S. No.*** | ***Medium*** | ***Colour*** | ***RAL*** | ***COLOUR*** | ***ISC No*** | ***RAL #*** | ***Legend*** | ***Remarks*** |
| **1.** | **WATER** | | | | | | | |
| a. | Untreated or Raw/ service | Grey | 9002 | Sea Green | 217 | | RW/SW | |
| b. | Treated | Grey | 9002 | Sea Green | 217 | | PW | |
| **2.** | **AIR** | | | | | | | |
| a. | Instrument | Grey | 9002 | Sky blue | 101 | | IA | |
| b. | Service/ Plant | Grey | 9002 | Sky blue | 101 | | PA | |
| **3.** | **OILS** | | | | | | | |
| a. | High speed diesel | Grey | 9002 | Light brown * | 410 | | HSD | * Hazard Mark |
| b. | Lubricating oil | Grey | 9002 | Light brown | 410 | | LO | * Hazard Mark |
| c. | Hydraulic | Grey | 9002 | Light | 410 | | HYD.O | |

| | | Ground Colour | | Identification Tag/ Band Colour | | | | |
|---|---|---|---|---|---|---|---|---|
| **S. No.** | **Medium** | **Colour** | **RAL** | **COLOUR** | **ISC No** | **RAL #** | **Legend** | **Remarks** |
| | power | | | brown | | | | |
| d. | Control fluid | Grey | 9002 | Light brown | 410 | | CR.O | |
| e. | Transformer oil | Grey | 9002 | Light brown | 410 | | TR.O | |
| **4.** | **FIRE INSTAL-LATIONS** | Fire Red | 536 (ISC) 3001 (RAL) | White | | 9010 | FIRE | Legend in Red Letters over White Background |

**Note :** 1. Ground colour indicated against each piping shall be followed in case piping is not insulated /cladded.

2 For any equipment not covered above, colour codification shall be furnished by employer during detail engineering.

ANNEXURE-IV

## SURFACE TREATMENT AND COATINGS

**Object:** The present specifications apply to equipment and spare part surface coating. They define surface coating, the types of recommended coating, and the associated guarantees. In any case, the Contractor shall submit to the Employer his coating schemes.

**1.00.00 CORROSION PROTECTION**

The Contractor shall take all necessary favorable measures to protect equipment from all abnormal corrosion and, taking into account project specific risks.

In particular, the Contractor shall choose the materials most suited to this project and shall submit a modification request to the Employer when the materials indicated in the specifications are considered unable to guarantee its behaviour against corrosion.

1.01.00 Equipment in Contact with Reservoir Water.

For all equipment on the water conveyance circuit (trashracks, valves, pipes, pump turbines instruments), the use of uncoated carbon steel is prohibited, even where corrosion allowance is planned. If he considers it necessary, the Contractor may apply stainless steel cladding to some carbon steel parts, or manufacture these parts in solid stainless steel.

If maintenance is unsure because of peculiar equipment arrangement, or if the equipment cannot easily be shutdown, the Contractor may submit to the Employer, alternative corrosion protection methods, so that vulnerable surfaces can be protected effectively.

1.01.01 Outdoor Exposed Equipment.

Among these equipment can be distinguished: those figuring as the subject of a particular specification, and for which the nature of materials and corrosion protection is clearly defined, those which, unlike the above, are not functional in nature and so are not subject to the same attention regarding problems of corrosion: parapets, gratings, lighting poles, etc. Even this second category of equipment shall be subject to particular attention with regard to choice of materials and corrosion protection.

In general, attention shall be paid to taking constructive measures or acquiring standard equipment, whatever the function, to avoid any water build-up. Such constructive measures are, for example: for constructive using structural sections (dam gates, stop logs), that all horizontal sheet metal sections have drainage holes at regular intervals, for auxiliary structures, embedding holes shall be completely filled with concrete, taking care to avoid any break in corrosion protection where concrete is exposed to the air.

**2.00.0 GENERAL**

The Contractor shall provide a complete and reliable surface treatment of the equipment furnished for corrosion protection.

Surface protection shall comprise:

A surface preparation phase with mechanical cleaning, grit blasting or chemical cleaning, a surface treatment phase with either metallizing and application of one or two priming coats suited to the type of metal surface, or application of priming coat, an application phase with several coatings of products, including final colored coat.

Surface protection shall be performed either in the Contractor's shops or on site with the necessary precautions taken.

Finishing touch-ups shall be performed on site upon completion of erection.

**3.00.00 SURFACE PREPARATION.**

All surfaces to be coated shall first be mechanically or chemically cleaned.

3.01.00 MECHANICAL CLEANING.

Surfaces shall be mechanically cleaned using one of the following methods:

shot-blasting or grit blasting, scraping, stripping, mechanical brushing.

3.01.01 SHOT-BLASTING OR GRIT BLASTING.

If mineral abrasives are used, they shall be selected in compliance with the prevailing regulations concerning workers' safety.

The required care levels of surface states after cleaning are defined by the illustrations in standard ISO 8501, or equivalent. The required care shall be as follows:

- preparation of steel surfaces to be imbedded set in concrete = Level 1,
- preparation of steel surfaces to receive definitive protection = Level 2.5,
- preparation of steel surfaces to receive metallized protection = Level 3.

The roughness of the cleaned surfaces shall be Ra = 12.5 µm, except for surfaces that shall be metallized later, for which the roughness shall be Ra = 6.3 µm.

3.01.02 SCRAPING, STRIPPING, MECHANICAL BRUSHING.

This type of cleaning shall concern:

- Parts to be set in concrete, which shall not be coated.

These parts shall be brushed immediately prior to concreting.

- Repair of defective surface coating. In this case, cleaning by scraping, stripping or brushing shall only be performed if shot-blasting or grit blasting is impossible.

The required care shall be as follows:

- St 2 for surfaces which shall subsequently receive a definitive coating.
- St 1 for surfaces to be set in concrete with no surface protection.

After cleaning, all surfaces shall be thoroughly dusted.

3.01.03 SURFACE PROTECTION REPAIR

Before surface protection is repaired, the old protection shall be partially or entirely removed. A new defects liability period shall start as soon as the zone in question has been repaired.

The old coating shall be completely removed by shot-blasting or grit blasting, in compliance with the specifications in 3.01.01.

If this process is impossible, the old coating shall be removed by scraping, stripping or mechanical brushing, in compliance with the specifications in 3.01.02.

**4.00.00 CHEMICAL CLEANING**

All traces of pollution shall be removed with solvents (degreasing, neutralisation).

The surfaces shall then be rinsed and dried (with special cleaning paper).

The Contractor shall submit, for the Employer's approval, a list with the characteristics of the solvents that he intends to use.

**5.00.00 SURFACE TREATMENT**

Immediately after surface preparation, the Contractor shall employ one of the following three surface treatment processes:

**6.00.00 METALIZING**

Metalizing shall be performed within 2 hours after preparation.

The chemical composition of the metal used shall be: 85 % Zinc - 15 % Aluminum. The thickness shall be 120 µm.

Application shall be by spray gun in compliance with ISO standard R 2053.

After metalizing, pores shall be plugged by applying a wash primer, or, if the equipment is intended for immersion, by applying a thin coat of zinc epoxy (max. 20 µm).

**7.00.00 HOT GALVANIZING**

This coating performed by quenching shall have the following characteristics:

- minimum unit mass : 5g/dm$^2$,
- average thickness : 70 µm

This process shall be used when metalizing cannot be performed under satisfactory conditions.

**8.00.00 PRIMING COAT APPLICATION**

This coating shall have the following characteristics:

- product : zinc epoxy coat,
- thickness : minimum 40 µm.

**9.00.00 APPLICATION OF THE PROTECTION**

The Contractor shall carefully control relative humidity and temperature before and during applying any coating. In any case, the relative humidity shall not exceed 80%.

All traces of condensation shall be eliminated before protection is applied. If the relative humidity remains between 50 and 80%, the first coat shall be applied four (4) hours after the surface preparation.

The undercoats or finish coats shall be applied in compliance with the drying time required between each application.

Each coat shall be of a different color.

**10.00.00 TOUCH-UPS**

If more than 20 % of the total surface area of a given zone shall be touched-up, the Contractor shall replace the surface treatment over the entire surface.

**11.00.00 PROTECTION OF THE SURROUNDING SURFACES**

The Contractor shall take every measure to protect the surrounding equipment and surfaces from product spattering, and from any damage caused by the surface preparation that he performs.

Equipment or surfaces that are soiled or deteriorated in spite of these measures shall be repaired or cleaned, or if this is impossible, replaced at the Contractor's expense.

**12.00.00 CARBON STEEL - STAINLESS STEEL CONNECTION**

**When carbon steel and stainless steel parts are connected, the surface coating shall be prolonged by 50 cm on the stainless steel part.**

**13.00.00 TYPES OF COATING**

The coatings to be applied, except when expressly stipulated otherwise in the equipment specifications, shall be defined as follows:

**14.00.00 CARBON STEEL SURFACES IN CONTACT WITH WATER**

| System chosen | Thickness |
|---|---|
| • 1 zinc epoxy priming coat | 40 µm |
| • 2 or 3 coats of epoxy-coal pitch finishing paint | 2 x 225 or 3 x 150 µm |

The system's minimum thickness shall be 450 µm.

The complete protection shall be applied in the shop, except when expressly waived by the Employer, and on site intervention shall be limited to touch-ups.

**15.00.00 CARBON STEEL SURFACES IN CONTACT WITH AIR AND INSTALLED OUTSIDE**

| System chosen | Thickness |
|---|---|

| | |
|---|---|
| • 1 epoxy priming coat | 40 µm |
| • 2 or 3 coats of epoxy-coal pitch finishing paint | 2 x 225 or 3 x 150 µm |

The system's minimum thickness shall be 450 µm.

The complete protection shall be applied in the shop, except when expressly waived by the Employer, and on site intervention shall be limited to touch-ups.

**16.00.00 CARBON STEEL SURFACES UNDER COVER THAT STILL RISK CONDENSATION**

| System chosen | Thickness |
|---|---|
| • Zinc epoxy priming coat | 40 µm |
| • 2 coats colored solvented epoxy pitch | 2 x 150 µm minimum |

The system's minimum thickness shall be 300 µm.

The complete protection shall be applied in the shop, except when expressly waived by the Employer, and on site intervention shall be limited to touch-ups.

**17.00.00 CARBON STEEL SURFACES UNDER COVER WITH NO RISK OF CONDENSATION**

| System chosen | Thickness |
|---|---|
| • Zinc epoxy priming coat | 50 µm |
| • 2 coats colored solvented epoxy pitch | 2 x 100 µm minimum |

The system's minimum thickness shall be 200 µm.

The complete protection shall be applied in the shop, except when expressly waived by the Employer, and on site intervention shall be limited to touch-ups.

**18.00.00 CARBON STEEL SURFACES IN CONTACT WITH OIL**

| System chosen | Minimum thickness |
|---|---|
| • 2 coats of epoxy-polyamide paint containing aluminum | 2 x 75 µm minimum |

The Contractor shall ensure that the paint chosen is compatible with the oil in contact.

The complete protection shall be applied in the shop.

**19.00.00 TEMPORARY PROTECTION OF GROOVES**

The grooves, along with an area from 100 to 150 mm on either side of them, shall receive a temporary protective coating, according to the following system:

| System chosen | Minimum thickness |
|---|---|
| • 1 coat of weldable epoxy-zinc paint | 40 µm |

**The complete protection shall be applied in the workshop.**

**20.00.00 TEMPORARY PROTECTION FOR MACHINED SURFACES**

The surfaces shall be degreased, rinsed and dried before application of the temporary protective coatings.

| System chosen | Minimum thickness |
|---|---|
| Solvented corrosion resistant paint | |
| • 2 coats for oxidizing surfaces | 2 x 35 µm |
| • 1 coat for non-oxidizing surfaces | 1 x 35 µm |

**The protection shall be applied in the shop and eliminated on site before erection, using a rag impregnated with a solvent compatible with the materials temporary protected.**

**21.00.00 CONDENSATION PROTECTION**

The Employer and the Contractor shall mutually agree on the products to be used.

**22.00.00 SPARE PARTS**

The spare parts' surface coating shall be applied in compliance with the present specifications.

All temporary surface protections (until the spare parts are used) shall be designed to last for 15 years storage of the parts.

**23.00.00** **COLOR OF THE FINISH COAT**

The Employer shall define the color of the finish coat.

**24.00.00** **PROTECTION THICKNESS**

Protection thickness shall be checked in compliance with the following specifications:

24.01.00 Number of measurement points

The number of measurement points is defined in the following table:

| Size of the surface to be tested (reference zone, in m² or in linear meter)) | Number of measuring points recommended |
|---|---|
| < 10 | 10 to 20 |
| 10 to 100 | 20 to 50 |
| 100 to 1000 | 50 to 100 |
| 1000 to 10000 | 100 to 200 |

24.02.00 Tolerance on system minimum thickness

Spot measurements less than the minimum thickness shall be accepted if both following conditions are fulfilled:

- the average of all the measurements performed on the reference zone is equal to or greater than the required minimum value, and
- no measurement point is less than 80% of the required minimum value.

In case of non-compliance with the criteria listed here above, the Contractor shall be obliged to touch up surface protection, either locally or completely.

The touch-up procedure shall be submitted to the Employer.

**25.00.00** **PRODUCT CHARACTERISTICS DATA SHEET**

For each product, the Contractor shall provide a characteristics data sheet specifying:

- the manufacturer's references,
- product characteristics,
- application conditions.

The Contractor shall submit a model data sheet to the Employer. This sheet shall

then be used for all surface protection works.

**26.00.00 PAINT/COATING QUALITY CONTROL SHEET**

During coating operations, the Contractor shall follow quality control procedure as agreed between the Employer and the Contractor:

**Annexure-V**

**TRAINING FOR ELECTRO-MECHANICAL PERSONNEL**

| SI No. | Description of Training | Training Duration | Place of Training | Number of Trainees from Employer |
|---|---|---|---|---|
| 1.00.00 | **Training During Engineering / Manufacturing Phase** | | | |
| 1.01.00 | **TURBINE, GOVERNING & AUXILIARIES** | | | |
| 1.01.01 | **Design & Quality Assurance**<br>(a)Turbine, Governing & Auxiliaries<br>• System description, Specific Design and engineering & Quality Assurance concepts for the offered equipment. Selection criterion for the Turbine, Governing and auxiliaries.<br>(b) Turbine Hydraulic characteristics<br>• Significance of Model & Model Testing<br>• Visit to Hydraulic Lab<br>• Explanation of Model Test Report (Efficiency , Runway speed and Hydraulic Transient)<br>(c) Mechanical Characteristics<br>• Construction & Quality Assurance of Turbine Components<br>(d) Study of Manufacturing & Quality Assurance Process<br>• Shop Tour<br>• Manufacturing Process of Key Components | 10 Days | Manufacturers works | 5 |

| Sl No. | Description of Training | Training Duration | Place of Training | Number of Trainees from Employer |
|---|---|---|---|---|
| 1.01.02 | **Operation & Maintenance**<br>• Brief description of Turbine, Governing & Auxiliary Systems<br>• Shop Tour<br>• Instruction to Assembly and Disassembly of Unit.<br>• Operation & Maintenance Practices<br>• Trouble shooting | 10 Days | Manufacturers works | 5 |
| 1.02.00 | **GENERATOR, GENERATOR EXCITATION SYSTEM INCLUDING AVR AND AUXILIARIES, GAS INSULATED SWITCHGEAR,PROTECTION SYSTEM** | | | |
| 1.02.01 | **Design & Quality Assurance**<br>• Design, Dimensioning, Testing & Quality Assurance aspects of Generating System, Insulation system, Cooling medium and arrangement, Winding and core support system and other auxiliary systems.<br>• Familiarization with different sub-systems & their process controls.<br>• Study of Manufacturing Process & Quality Assurance aspects for Core, Winding, and Assembly.<br>• Shop Tour<br>• Testing & Inspection Facilities familiarization.<br>• Functioning at reference plants | 10 Days | Manufacturers works | 5 |

| SI No. | Description of Training | Training Duration | Place of Training | Number of Trainees from Employer |
|---|---|---|---|---|
| 1.02.02 | Operation & Maintenance<br>• Brief description of Generator, excitation system, AVR & Auxiliary Systems<br>• Shop Tour<br>• Instruction to Assembly and Disassembly of equipments<br>• Operation & Maintenance Practice | 10 Days | Manufacturer's works | 5 |
| 1.02.03 | Gas Insulated Switchgear<br>• Design & Quality Assurance aspects of various sub-systems<br>• Familiarization with various equipment<br>• Test/Inspection Facilities Feedback<br>• Shop Tour | 5 Days | Manufacturer's works | 5 |
| 1.02.04 | Substation Automation System<br>• Design & Quality Assurance aspects of various sub-systems,<br>• Relay configuration, control configuration, setting calculations & Testing | 5 Days | Manufacturer's works | 4 |

| Sl No. | Description of Training | Training Duration | Place of Training | Number of Trainees from Employer |
|---|---|---|---|---|
| 2.00.00 | TRAINING DURING ERECTION/ INSTALLATION/ SITE WORK<br>- Lecture Hall Training by Contractor's Experts (besides demonstration at site) | | | |
| | Imparting On the job Training ( including training on Assembly & dismantling) at site to employer's Project Manager(s), associated during Erection, Installation / site work | | | |
| | (a) Turbine & Mechanical Aux. | 10 Days | SITE AND LECTURE HALL AT LATA TAPOVAN PROJECT | 8 |
| | (b) Generator, Excitation System & Electrical Aux. | 10 Days | | 8 |
| | (c) Switchyard- GIS & Pothead Yard | 2 Days | | 5 |
| | (d) Substation Automation System | 2 Days | | 5 |
| 3.00 | **TRAINING DURING TESTING & COMMISSIONING**<br>- Lecture Hall Training by Contractor's Experts besides demonstration at site (including training on Assembly & dismantling, O&M and Trouble Shooting. | | | |
| | (a) Turbine & Mechanical Aux. | 10 Days | SITE AND LECTURE HALL AT LATA TAPOVAN PROJECT | 8 |
| | (b) Generator , Excitation System & Electrical Aux. | 10 Days | | 8 |
| | (c) Switchyard - GIS & Pothead Yard | 3 Days | | 5 |
| | (d) Substation Automation System | 3 Days | | 5 |

**ANNEXURE-VI**

## TRAINING FOR C&I PERSONNEL

**1.00.00 GENERAL**

The Contractor shall provide course material, equipment, and trainers to train the Employer's personnel. Such training shall consist in formal training in operation, hardware, equipment and software maintenance, as set out in the paragraphs hereafter. When training is conducted outside the Employer's country, and in particular for participation of the Employer's engineers in the Contractor's studies, the Contractor shall be responsible for organization, all costs (including communications, documentation, office facilities, etc.) and correct running of the training.

All lectures, courses and course documents shall be in English. The trainers shall speak English. If necessary, interpreters shall be provided by the Contractor.

**2.00.00 TRAINING COURSES**

2.01.00 **Training in operation**

The Contractor shall provide operation training including at least:

- screen-keyboard operations,
- manipulation of the trackball or mouse,
- on-screen display,
- interpretation of the display,
- sets of tests,
- reloading the printers with paper,
- refilling the ink in the printers,
- exchanging peripheral devices,
- UPS operation,
- synchronizer,
- unit measurement system,
- LVS maintenance
- CRT maintenance

- LCU maintenance
- Telecommunication maintenance
- Historical data server maintenance
- Log station maintenance
- Plant Computer Maintenance
- Closed Circuit Television maintenance
- Public Address System maintenance

It shall cover:

- Operation from the power house Control Room,
- Operation from the Spillway Control Room,
- Operation from the switchyard Control Room,
- Operation from local control boards, at each location,
- Operation from drive control boards,
- Operation from each Operator Workstation,
- Monitoring from remote operator workstation in the Employer's OS control room.
- Engineering functions of the engineering station

Operation training shall be provided on site during commissioning.

2.02.00 **Hardware and equipment training**

The Contractor shall provide SCADA System hardware maintenance training and equipment training at the Contractor's premises. This training shall include at least the following:

- Basic studies:
  - processor,
  - hardware configuration,
  - electronic board and bus configuration,
  - tests,

- network,
- functional architecture.

◆ Detailed studies:

- plant computer,
- operator workstation,
- engineer station,
- Local supervision station,
- local control units,
- internal communication network,
- interface devices
- synchronization devices of the unit on the grid,
- UPS,
- clock synchronization and distribution equipment

2.03.00 **Software maintenance training**

The Contractor shall provide real time software maintenance training at the Contractor's premises. This training shall include at least the following:

◆ Basic studies:

- operating system,
- operating system nucleus,
- data base kernel,
- diagnostic programs,
- application programs.

◆ Detailed studies:

- modification of the data base,
- modification of views,
- system fault management,

- start/stop,
- communication

◆ Process description:

- normal operation,
- process fault management.
- Emergency operation

**3.00.00 DURATION AND TRAVEL**

The duration and number of trips indicated in the table hereafter are to be considered as minimum.

| | Location | Number of trainees | Duration of training |
|---|---|---|---|
| Training in operation & maintenance | Lata-Tapovan Project Site | 10 | 10 days |
| Hardware and Equipment Training<br>-Basic studies<br>-Detailed studies<br>-Equipment | Manufacturer's Premises | 5 | 10 days |
| Software Maintenance Training<br>- Basic studies<br>- Detailed studies<br>- Process description | Manufacturer's Premises | 5 | 10 days |

**ANNEXURE-VII**

**NOISE**

**OBJECT: THE PRESENT SPECIFICATION DEFINES ACCEPTABLE NOISE LEVELS IN THE POWER STATION, ASSOCIATED PREMISES AND OUTSIDE THE POWER STATION ENCLOSURES.**

**1.00.00 GENERAL**

The Contractor shall be responsible for the noise emitted by his equipment within its immediate environment and the areas around it.\

Generally, the Contractor shall attempt to reduce the noise emitted by his equipment, whatever its nature (impact, transmitted, echo, etc.), and shall analyse at an early stage the effects of installing noise reduction devices on neighbouring civil works structures or equipment.

This shall apply to all type of normal operation, including the transient states between one operating mode and another.

**2.00.00 SOUND LEVELS**

The noise emitted by the equipment shall be evaluated according to sound pressure levels expressed in decibels in compliance with IEC/IS or equivalent.

2.01.00 **Outside**

Installations' noise impact on the environment shall be limited.

If necessary, the Contractor shall fit his equipment with noise reduction devices, such as covers or silencers.

2.02.00 **Within Premises**

2.02.01 Control Room, Offices

Noise levels shall not exceed 60 dB (A) in the control room and in offices that are not always in use; in offices in permanent use levels shall not exceed 45 dB(A).

2.02.02 Power Station Noise Level

The equivalent 'A' weighted sound pressure level measurement at a height of 1.5 M above floor level in elevation and at a distance of one (1) M horizontally from the nearest surface of any equipment/machine, furnished and installed under these specification, expressed in decibels to a reference of 0.0002 microbar shall not exceed 85 dB(A) except for premises where access is prohibited when equipments are in service, like operation area of runner, thrust bearing, and generator, where no noise limit shall be imposed.

The method proposed for measurement shall be in accordance with the relevant standards/norms and shall be submitted to the Employer for acceptance.

2.03.00 **Noise Attenuation**

The Contractor shall use all possible solutions at attenuate nose produced by his equipment, and in particular:

- Installation of sound-proofed doors for access to high noise level rooms (e.g. generator),
- sufficient thick casing around the noisy parts of units,
- installation of covers on some auxiliaries,

In all cases, whatever sound-proofing methods are used, care shall be taken to seal off all ducts and feed-throughs in walls and enclosures around significant sound sources, in order to comply with specified objectives.

**ANNEXURE-VIII**

## VIBRATION CRITERIA

**1.0 GENERAL**

The Contractor shall design and install his equipment in such a way as to prevent excessive vibrations which may harm his equipment or any neighboring structures and equipment.

This shall apply to all types of normal operation, including the transient states between one operating mode and another.

Vibrations and shocks to equipment from external sources shall comply with IEC standard 721 (also regarding non-electrical equipment).

**2.0 Acceptance Criteria**

**2.1 Turbine-Generator Unit**

**2.1.1** Balancing

The Contractor shall balance the unit in accordance with ISO standard 1940. In all cases of normal operation, the criterion shall be fixed at G 6.3 mm/s for the turbine runner. The criterion shall be fixed at G 2.5 mm/s for the generator.

The unit's balance shall comply with the conditions stipulated in Clause 2.1.2 of the present specification.

**2.1.2.** Measurements at commissioning

**2.1.2.1** Preliminary vibration analysis

At commissioning of the unit, it shall be required to carry out a preliminary vibration analysis, consisting of a spectral analysis of vibration of non-rotating parts (bearings). Each individual peak shall be identified, its level (in mm/s) shall be registered. The recordings shall be transmitted to the Employer, stipulating the test conditions and the recording and sampling parameters.

The obtained values shall not be guaranteed.

**2.1.2.2.** Guaranteed vibration levels

***2.1.2.2.1 Acceptance standards***

At commissioning of the unit, the Contractor shall take vibration measurements in compliance with ISO standard 10 816-5 for the non-rotating parts and ISO standard 7919-5 for the rotating shafts.

**2.1.2.2.2** ***Operational conditions***

Measurements shall be carried out with the machine running under the following stationary conditions:

- at no-load - uncoupled,
- at no-load - coupled,
- at 25%, 50%, 75%, 100% of rated output,
- at maximum power.

For each power stage, three reactive power levels shall be tested: none, supplied and absorbed. For each power stage, operational temperatures (bearings, etc.) shall be in a steady state.

**2.1.2.2.3** ***Acceptance criteria for measurements on non-rotating parts***

The guaranteed values for the 75% and 100% of rated output shall be those indicated in Appendix A of the ISO standard 10 816-5. The values taken into account shall be in compliance with this standard for the A/B area. The measurements for the other loads shall be submitted to the Employer and shall not be guaranteed.

**2.1.2.2.4** ***Acceptance criteria for measurements on rotating shafts***

The guaranteed values for the 75% and 100% of rated output shall be those indicated in Appendix A of the ISO standard 7919-5. The values taken into account shall be in compliance with this standard for the A area. The measurements for the other loads shall be submitted to the Employer and shall not be guaranteed.

**2.2** Other Rotating Machines (pumps, motors, gearing, fans, etc.)

The vibratory level of the machines shall be in compliance with the ISO standard 10816-3 Appendix A/ relevant Indian Standard.

The Contractor shall also take all necessary steps to prevent the transmission of vibrations to neighboring structures (specially diesel engines).

**2.3** Other equipment susceptible to causing vibrations (bypass, valves, etc.)

The Contractor shall ensure that pressure fluctuations or vortices induced by the flow of water, oil or air do not cause vibrations harmful to equipment, do not transmit vibrations to civil works structures and do not constitute unpleasant acoustic sources. The Contractor shall take all necessary steps to attenuate vibrations, to isolate equipment transmitting vibrations and/or to ensure that these vibrations do not have harmful effects (adequate dimensioning, resonant frequencies sufficiently distant from excitation frequencies).

ANNEXURE - Q3

| MFGR.'s LOGO | MANUFACTURER'S NAME AND ADDRESS | MANUFACTURING QUALITY PLAN | | PROJECT :<br>PACKAGE :<br>CONTRACT NO. :<br>MAIN-SUPPLIER: |
|---|---|---|---|---|
| | | ITEM :<br>SUB-SYSTEM: | QP NO.:<br>REV.NO.:<br>DATE:<br>PAGE: .... OF.... | |

| 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. |
| | | | | | | | | | | | | | | |

| MANUFACTURER/ SUB-SUPPLIER | MAIN-SUPPLIER |
|---|---|
| SIGNATURE | |

**LEGEND:** * RECORDS, INDENTIFIED WITH "TICK" ( √ ) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION
** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC
P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE,
CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS ' W"

FOR NTPC USE

| DOC. NO.: | | REV..... CAT..... |
|---|---|---|
| | | |
| REVIEWED BY | APPROVED BY | APPROVAL SEAL |

ANNEXURE-G5

| SUPPLIER'S LOGO | SUPPLIER'S NAME AND ADDRESS | FIELD QUALITY PLAN | | PROJECT :<br>PACKAGE :<br>CONTRACT NO. :<br>MAIN-SUPPLIER: |
|---|---|---|---|---|
| | | ITEM :<br>SUB-SYSTEM: | QP NO.:<br>REV. NO.:<br>DATE:<br>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 | |

LEGEND: * RECORDS, INDENTIFIED 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 NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

NTPC

FOR NTPC USE

| DOC. NO.: | | REV..... |
|---|---|---|
| REVIEWED BY | APPROVED BY | APPROVAL SEAL |

ANNEXURE-G2

| CLAUSE NO. | GENERAL TECHNICAL REQUIREMENT |
|---|---|

***Attachment-IV to Amendment No. 3 to Technical Specification Section VI***

27.00.00 PAINTING/ COATINGS FOR VARIOUS PIPES

Coating/ painting of carbon steel pipes and their supports shall be as follows:-

| Sl. No. | Pipe/ structure | Coating/ Painting data | DFT |
|---|---|---|---|
| 1.1 | Above ground black piping and all steel surfaces exposed to atmosphere **(outside Installation)** | One (1) coat of Epoxy Zinc Phosphate Primer | 35-50 microns per coat |
| 1.2 | | Three (3) coats of Epoxy resin based finish paint | 25-35 microns per coat<br>Total DFT (min): 75 micron |
| 2.1 | Above ground black piping and all steel surfaces **(indoor Installation)** | One (1) coat of Epoxy Zinc Phosphate Primer | 35-50 microns per coat |
| 2.2 | | Two (2) coats of Epoxy resin based finish paint | 25-35 microns per coat<br>Total DFT (min): 50 micron |

ANNEXURE-G3

| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|
| | | **B. Subject Matter of Contract** |
| 7. | **Scope of Facilities** | 7.1 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 required for the design, the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Precommissioning 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; 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 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. The prices of spares covered under the Price Schedule No. 6 shall be kept valid for a period as specified in SCC. |
| | | 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. |
| | | 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. |



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7.3.1.2 All the mandatory spares covered under the Contract shall be produced alongwith the main equipment as a continuous operation and the delivery of the spares will be effected alongwith the main equipment in a phased manner and the delivery would be completed by the respective dates for the various categories of equipment as per the agreed network. 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.

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.

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.

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.

7.3.1.6 The quality plan and the inspection requirement finalised for the main equipment will also be applicable to the corresponding spares.

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.

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 atleast 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.

7.3.1.9 The prices of all future requirements of item of spares beyond 3 years operatoinal 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 excepting that the base indices will be counted from the scheduled date of Commissioning of the last equipment 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 the Employer shall remain valid for the period of 5 years from the date of Commissioning of the equipment.

7.3.1.10 The Contractor will indicate in advance the delivery period of the items of spares, which the Employer may procure in accorance 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.

7.3.1.11 In case the Contractor fails to supply the mandatory, recommended 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.

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.

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 de-



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fects in design, material and workmanship and shall further guarantee as under :

(i) For 3 years operational spares (both mandatory and recommended)

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. '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 upto and including rated capacity. Such declaration by the Employer, however, shall not relieve or prejudice the Contractor any of his obligations under the Contract. In case of any failure in the original component/equipments 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.

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.

c) For long term requirement

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.

ii) The Defect Liability of spares covered in para (b) & (c) 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.

8. **Time for Commencement and Completion**

8.1 The Contractor shall commence work on the cilities 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 (including any data as to boring tests) 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 twenty-eight (28) days prior to 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



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ANNEXURE - 44

| Clause No. | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|
| 21. | **Procurement** | 21.1 **Plant and Equipment**<br>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.<br><br>21.2 **Employer-Supplied Plant, Equipment, and Materials**<br>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:<br><br>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.<br><br>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.<br><br>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.<br><br>21.3 **Transportation**<br>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.<br><br>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.<br><br>21.3.3 Upon despatch of each shipment of the Plant and Equipment and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or Electronic Data Interchange |



Contractor = Bidder
Store to be provided by BHEL.

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(EDI) 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 shall furnish the Employer with relevant shipping documents to be agreed upon between the parties.

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 endeavors 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.

21.4 **Customs Clearance**

The Contractor shall, at its own expense, handle all imported Plant and Equipment and Contractor's Equipment 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.

22. **Installation**

22.1 **Setting Out/Supervision/Labour**

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.

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.

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.

22.1.3 Labour:

(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 is encouraged to use local labour that has the necessary skills.

(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.

(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.

(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.

(e) The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous or disorderly conduct or behavior by or amongst its employees and the labour of its Subcontractors.

(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.

22.1.4- refer Annexure-G4A

22.2 **Contractor's Equipment**

22.2.1 All Contractor's 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



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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.

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.

22.2.3 The Employer will, if requested, use its best endeavors 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.

22.3 **Site Regulations and Safety**

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.

Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention.

22.4 **Opportunities for Other Contractors**

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.

22.4.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads 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.

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.



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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.

22.5 **Emergency Work**

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.

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.

22.6 **Site Clearance**

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.

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.

22.7 **Watching and Lighting**

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.

22.8 **Work at Night and on Holidays**

22.8.1 Unless otherwise provided in the Contract, no work shall be carried out during the night and on public holidays of the country where the Site is located without prior written consent of the Employer, except where work is necessary or required to ensure safety of the Facilities or for the protection of life, or to prevent loss or damage to property, when the Contractor shall



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immediately advise the Project Manager, provided that provisions of this GCC Sub-Clause 22.8.1 shall not apply to any work which is customarily carried out by rotary or double-shifts.

22.8.2 Notwithstanding GCC Sub-Clauses 22.8.1 or 22.1.3, if and when the Contractor considers it necessary to carry out work at night or on public holidays so as to meet the Time for Completion and requests the Employer's consent thereto, the Employer shall not unreasonably withhold such consent.

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 traveling 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 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.

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.

23.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, 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 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 Adjudicator for determination in accordance with GCC Sub-Clause 6.1 (Adjudicator).

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 the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition 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 specified in Appendix 6 (Scope of Works



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and Supply by the Employer) to the Contract Agreement, required for Precommissioning of the Facilities or any part thereof.

Unless otherwise specified in the Technical Specifications, the Employer shall also provide, within the said seven (7) day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Precommissioning 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 Precommissioning of the Facilities or the relevant part thereof in preparation for Commissioning.

24.4 As soon as all works in respect of Precommissioning 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 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.

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.

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.

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.

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



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ANNEXURE-G4A

# AMENDMENT NO. 3 TO SECTION I, II. III, IV & V OF THE BIDDING DOCUMENTS

| Sl. No. | Reference | Existing Provision | Amended Provision |
|---|---|---|---|
| 1. | **New Clause** [SCC No. 20 of Special Conditions of Contract (SCC), Section-V];<br><br>GCC Ref. Clause No. 22.1(Setting Out/ Supervision/ Labour): | ---------- | "New GCC Sub-Clause 22.1.4 is added, as under:<br><br>In case the Contract is awarded to a Foreign Company / Joint Venture with atleast one Foreign Partner/ Company with atleast one Foreign Associate, following shall apply:<br><br>(a) Project Manager, NTPC/ NHL would evaluate and determine the optimum number of Foreign Employees required to be deployed at the Project, awarded or sub-contracted, keeping in view the Project's requirements, location and technical necessities.<br><br>(b) Foreign Employees would ordinarily be expected to confine their stay and movements to the designated place of stay and Project Site. Any visits outside the Project site in any Restricted / Protected areas would only be undertaken after permission from the Competent Authority/ Government Authorities is obtained through the company in which they are employed, failing which they will be liable to action as per prevalent rules and orders.<br><br>(c) If personnel of the foreign company(ies) are found indulging in activities prejudicial to India's national security interest, then the NTPC/ NHL may cancel the Contract without any liability.<br><br>(d) A list of Employees of the Foreign Companies/ Foreigners (Consultants, Contractor, Employees / Retainers) proposed to be engaged in the Project shall be furnished to Project Manager, NTPC/ NHL which will include full particulars (Passport details, Job profiles/ expertise, duration/ location of stay etc.) well in advance for requisite vetting before issuance of Visa. |

## AMENDMENT NO. 3 TO SECTION I, II. III, IV & V OF THE BIDDING DOCUMENTS

| Sl. No. | Reference | Existing Provision | Amended Provision |
|---|---|---|---|
| | | | (e) The kind of Visa to be issued, to the Employees of the Foreign Companies will be decided by the concerned authorities of Government of India.<br><br>(f) While issuing Visa/ Work Permits, concerned authorities of Government of India will impose the necessary restrictions on specific individuals or on employees of specific companies that need to be watched, as well as total no. of Visa to be issued at a given point of time in respect of Project, so as to ensure compliance of the Guidelines issued by Government of India.<br><br>(g) Participation by companies from China, Pakistan and Bangladesh either directly or by proxy is not acceptable.<br><br>(h) The employees/ Staff working for this Project are to be verified by Civil intelligence/ police agencies and issued with identity passes in accordance with existing rules.<br><br>The above provisions shall also apply in case of foreign sub-contractor(s), if any. |

ANNEXURE-95

| Clause No. | | | GENERAL CONDITIONS OF CONTRACT (GCC) |
|---|---|---|---|
| | | 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. |
| | | | **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 | 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.<br><br>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.<br><br>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.<br><br>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. |
| 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 | 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 |



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from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the SCC.

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 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:

(a) improper operation or maintenance of the Facilities by the Employer

(b) operation of the Facilities outside specifications provided in the Contract

(c) normal wear and tear.

27.3 The Contractor's obligations under this GCC Clause 27 shall not apply to

(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

(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

(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.

27.4 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.

27.5 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.

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.

27.6 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.

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.

27.7 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, proceed to do such work, 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.

27.8 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 therof.

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 the 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.

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 willful 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



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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

(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 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**

29.1 The Contractor shall, subject 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

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equipments measured at bearing housing shall not exceed forty (40) microns and shall conform to VDI 2056.All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

**43.00.00 DOWELLING**

All the motors and other equipment shall be suitably dowelled after alignment of shafts with tapered machined dowels as per the direction of the Employer.

**44.00.00 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.

**45.00.00 COMMISSIONING SPARES**

45.01.00 It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares like indicating lights/lamps, diodes, fuses recorder charts, ink pads/pens etc. required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 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.

45.02.00 These spare will be received and stored by the Contractor at least 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 performance and functional 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.

**46.00.00 EQUIPMENT DELIVERY AND ERECTION**

46.01.00 **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, 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.



Contractor = Bidder
Store to be provided by BHEL

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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.

46.02.00 **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 dessicants, 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) Dessicants 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 dessicants shall be of a chemical nature to absorb moisture. In any case, the dessicant shall not be of a type that will absorb enough moisture to go into solution. Dessicants shall be packed in porous containers, strong enough to withstand handling encountered during normal shipment. Enough dessicant shall be used for the volumes enclosed in wrapping.

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.



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g) An itemized list of contents shall been closed 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.

j) Electrical equipment, control and insulations 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.

k) Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures.

l) Coated surfaces shall be protected against impact, abrasion, discolouration and other damage. Surfaces which are damaged shall be repaired.

m) 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.

n) Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the plant site.

p) Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

q) While packaging the material, care shall be taken for the limitation from the point of view of availability of railway wagon sizes in India.



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46.03.00 **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 dismounted 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.

46.04.00 **Equipment Installation**

a) General Requirements

i) 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.

ii) 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.

iii) Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. The procedures shall be acceptable to the Employer.

iv) 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.



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c) **Regulatory Requirements**

All installation procedures shall confirm 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.

All free standing instrumentation cabinets and panels shall be located within the construction tolerances of +/- 3 mm of the location dimensions indicated on the Employer's plant arrangement drawings.

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**

i) 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.

ii) 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**

i) 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.

ii) 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.

iii) All brackets, stands, supports and other miscellaneous hardware required for mounting devices shall be furnished and installed.

iv) Thermometers shall be installed in the process lines and ducts as required and adjusted for ease in reading.

v) 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, please refer relevant Parts, Section-VI.

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.

(Also refer relevant Parts, Section VI).

k) **Piping Connections**

i) 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.

ii) All flanged joints shall be checked and retightened after approximately 10 days of operation at normal operating temperature.



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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**

i) 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.

ii) 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**

i) 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.

ii) The equipment shall be protected during storage as described herein.

iii) Equipment shall be protected from weld spatter during construction.

iv) Protective Guards

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.

v) 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.

vi) 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.



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**47.00.00** **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.

**48.00.00** **DEVIATION DISPOSITIONING**

Any deviation to the contract and employer approved document shall be properly recorded in the format prescribed by the Employer. All the deviations shall be brought to the knowledge of employer's representative for suitable dispositioning.

**49.00.00** **Non-Destructive Testing (NDT)**

The Contractor shall record results of NDT, carried out at site in the format acceptable to employer. All the radiographs & its report duly signed & corrected to the job shall be handed over to the employer. Sensitivity of all the rest equipment shall be compatible to the job & acceptance norms agreed.

**50.00.00** **TESTING EQUIPMENT & FACILITIES**

Contractor shall provide the testing equipment and facilities necessary to carryout tests & inspections.



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# SECTION 4

## GAURANTEED TECHNICAL PARTICULARS

Enclosed:

NTPC Spec Technical Data Sheet for 220 kV XLPE System (Part G,. Section VI, page 1 to 7)

Bidder's Name: .....

## TECHNICAL PARTICULARS

Technical Information and data to be submitted with proposal.

**I) Testing and Calculations:**

**A. Pre-Qualification Test**

1. Manufacture meeting the requirement of IEC: 62067 with respect to Pre-Qualification test — Yes/No

2. Certificates and detailed Pre-Qualification Test Reports enclosed alongwith the Bid.

**B.** Complete Technical Literature supported by catalogues giving constructional feature, cross section drawings, type of material, installation practices with respect to 220kV cables and Accessories and any other relevant general information enclosed alongwith the bid.

**C.** Metallic screen and sheath sizing calculations meet the short circuit requirements enclosed alongwith the bid.

**II) TECHNICAL PARTICULARS:**

| Sl. No. | Particulars | Unit | Details / Values |
|---|---|---|---|
| **A.** | **220 KV Cables** | | |
| 1. | Manufacturer's name & Country of origin | | |
| 2. | Standards according to which cable is manufactured and tested | | |
| 3. | Type | | |
| 4. | No. of phases per circuit | | |
| 5. | No. of cables per phase | | |
| 6. | No. of cores per cable | | |
| 7. | Rated Voltage | KV | |
| 8. | Highest system voltage | KV | |
| 9. | Rated continuous current | A | |
| 10. | Rated short-time current withstand capacity for 1 second | | |
| a) | For conductor | KA | |
| b) | For metallic sheath | KA | |
| 11. | Electrical stresses (AC Voltage) Short circuit forces | | |
| a) | On conductor | | |
| i) | Average | KV/mm | |
| ii) | maximum | KV/mm | |

Bidder's Name: .....

| | | | |
|---|---|---|---|
| | b) | On conductor screen semi-conductor layer | |
| | i) | Average | KV/mm |
| | ii) | Maximum | KV/mm |
| | c) | On insulation screen semi-conductor layer | |
| | i) | Average | KV/mm |
| | ii) | Maximum | KV/mm |
| | d) | Insulation | |
| | i) | Average | KV/mm |
| | ii) | Maximum | KV/mm |
| 12. | | Rated frequency | Hz |
| 13. | | Insulation level | |
| | a) | Power Frequency withstand voltage | KV |
| | b) | 1.2/50 micro-second lightning impulse withstand voltage | KV (peak) |
| | c) | 250/2500 micro-second switching impulse withstand voltage | KV (peak) |
| 14. | | Temperature | |
| | a) | Max. temperature rise over ambient temperature of 40°C | °C |
| | b) | Maximum permissible conductor temperature during short circuit | °C |
| | c) | Heating time constant when cable is switched on | |
| | i) | From zero load (cold condition) to a load of continuous current and corresponding conductor temperature | seconds |
| | ii) | From zero load (cold condition) to a load of maximum continuous current to attain 90°C temperature, keeping the load constant | Seconds |
| 15. | | | |
| | a) | Guaranteed Power loss in conductor in each cable length at rated voltage and current | W |
| | b) | Guaranteed Dielectric power loss in each cable length at rated voltage and current | W |
| | c) | Guaranteed power loss in metallic sheath in each cable length at rated voltage and current | W |
| | d) | Guaranteed total power loss in each cable length at rated voltage and current (a+b+c) | W |
| | e) | Maximum permissible iron losses in supporting structures | kW |

Bidder's Name: .....

| | | |
|---|---|---|
| 16. | Maximum total power losses per meter | W |
| 17. | Conductor details | |
| a) | Type | |
| b) | Material and shape | |
| c) | Cross-sectional area | $mm^2$ |
| d) | No. of strands/Diameter of each strand | No./mm |
| e) | Weight of copper in cable | Kg/m |
| f) | Current density in conductor | $A/mm^2$ |
| g) | Conductivity of conductor | Mho/m |
| h) | Ultimate tensile strength of conductor | $N/mm^2$ |
| i) | Maximum short-circuit current rating & duration | KA/sec. |
| j) | Impedance of conductor per meter | Ω |
| k) | Resistance per meter | |
| i) | DC at 20°C | Ω |
| ii) | AC at 20°C | Ω |
| 18. | Conductor screening | |
| a) | Material | |
| b) | Thickness | mm |
| c) | Electric stress level | |
| i) | Maximum | KV/mm |
| ii) | Average | KV/mm |
| d) | Maximum resistivity | Ω-m |
| 19. | Insulation details | |
| a) | Material | |
| b) | Thickness | mm |
| c) | Relative permittivity | |
| d) | Dielectric loss angle (at rated voltages at 20°C & 90°C) | |
| e) | Insulation resistance constant | Ω-cm |
| f) | Elongation | % |
| g) | Tensile strength | N/mm2 |
| 20. | Insulation screening | |
| a) | Material | |
| b) | Thickness | mm |
| c) | Electric stress level | KV/mm |
| d) | Maximum resistivity | Ω-m |
| 21. | Bedding (cushion layer) | |
| a) | Material | |
| b) | Total Thickness | mm |
| 22. | Metallic sheath | |
| a) | Material | |
| b) | Type | |
| c) | Thickness | mm |
| d) | Maximum short circuit current rating & duration | KA/sec. |
| e) | Sheath induced voltage | V |

Bidder's Name: .....

| | | |
|---|---|---|
| f) | Type of earthing | |
| g) | Diameter of cable over Metallic sheath | mm |
| h) | Mutual inductance between conductor and sheath | mH/km |
| i) | Resistance per meter | |
| i) | DC at 20° C | Ω/m |
| ii) | AC at 20° C | Ω/km |
| 23. | Outer sheath | |
| a) | Material | |
| c) | Thickness | mm |
| d) | Colour | |
| e) | Oxygen index | |
| f) | Carbon black contents for PE | % |
| 24. | Overall diameter of cable | mm |
| 25. | Cable weight | Kg/m |
| 26. | Inductive reactance per phase per meter at 20°C | Ω |
| 27. | Capacitance per phase per meter at 20°C & 50Hz | µF |
| 28. | Effective AC resistance per phase per meter | Ω |
| 29. | Surge impedance | Ω |
| 30. | DC resistance at 20°C | Ω/km |
| 31. | Maximum safe continuous current at ambient temperatures varying from sub zero to(+) 40° C | A |
| 32. | Charging current & power | |
| a) | Maximum charging current per phase | A/km |
| b) | Maximum charging current per circuit | A/km |
| c) | Maximum charging power per circuit | KVA/km |
| 33. | Cable insulation resistance | M Ω |
| 34. | Cable burn through time at rated short circuit current | Sec. |
| 35. | Corona Extinction voltage | kV |
| 36. | Radio interference at 266 kV (rms) | µV |
| **B.** | **220kV Cable Accessories** | |
| **1.** | **Outdoor termination** | |
| a) | Name and country of manufacturer | |
| b) | Type | |
| c) | Insulating medium | |
| d) | Type of interface | |
| e) | Material and colour of the bushing | |
| f) | Bushing particulars | |
| i) | Make & country of manufacture | |
| ii) | Type | |
| iii) | Voltage class | KV |

Bidder's Name: .....

| | | | |
|---|---|---|---|
| iv) | | Power frequency withstand voltage | KV |
| v) | | Lightning impulse withstand voltage | KV(peak) |
| vi) | | Switching impulse withstand voltage | KV(peak) |
| vii) | | Flash over values | |
| | | -Dry | KV |
| | | -Wet | KV |
| viii) | | Puncture values | KV |
| ix) | | Creepage distance | mm |
| x) | | Compression strength | $Kg/cm^2$ |
| xi) | | Cantilever strength | Kg-m |
| xii) | | Pressure differential withstand capacity of insulators | |
| xiii) | | Minimum creepage distance of porcelain bushing | mm /KV |
| g) | | Is terminal type tested, if yes, to which standard? | |
| h) | | Overall dimensions of termination | mm |
| i) | | Connecting clamps | |
| i) | | Normal current rating | KA |
| ii) | | Short circuit current rating | KA |
| iii) | | Overall dimensions (LxBxH) | mm |
| iv) | | Permissible tension for outdoor termination | $Kg/mm^2$ |
| **2.** | | **Indoor Termination** | |
| a) | | Name and country of manufacture | |
| b) | | Type | |
| c) | | Insulation medium | |
| d) | | Type of interface | |
| e) | | Is terminal type tested, if yes, to which standard? | |
| f) | | Overall dimensions (LxBxH) | mm |
| g) | | Overall weight | Kg |
| h) | i) | Normal current rating | A |
| | ii) | Short circuit current rating | KA |
| i) | | Max. permissible pressure of SF6 gas in indoor termination | |
| j) | | Designed pressure of SF6 gas in indoor termination | |
| k) | | Permissible tension for indoor termination | $Kg/mm^2$ |
| **C**. a) | | **Disconnecting Link (CCPU)** | |
| i) | | Material and size | |
| ii) | | Continuous current rating | A |
| iii) | | Momentary current rating | KA |
| b) | | **Earthing Devices** | |
| i) | | **Earthing conductor** | |
| - | | Material & size | |

Bidder's Name: .....

| | | | |
|---|---|---|---|
| | - | Continuous current rating | A |
| | - | Momentary current rating | KA |
| | ii) | **CCPU Cable link Box** | |
| | - | Material | |
| | - | Size & weight | |
| | - | Protection code | |
| | iii) | **Technical particulars of Sheath Voltage Limiter (SVL)** | |
| | - | Type | |
| | - | Rated voltage | KV |
| | - | Voltage limiting range | |
| | - | Fault current rating for 1 second | KA |
| | - | Lightning impulse voltage withstand capacity | KV (peak) |
| | - | Power frequency withstand voltage | KV(rms) |
| | - | Momentary current rating | KA |
| | - | Continuous current rating | A |
| | - | Residual voltage | V |
| **D.** | | **Cable drums** | |
| | a) | Flange diameter | mm |
| | b) | Drum diameter & width | mm |
| | c) | Drum weight | Kg |
| | d) | Drum material | |
| | e) | Spindle hole diameter | mm |
| **F.** | | **Bonding Cable** | |
| | i) | Material | |
| | ii) | Size | $mm^2$ |
| | iii) | Type of bonding | |
| | iv) | Current carrying capacity | A |
| | v) | Voltage grade | V |
| **G.** | | **Other Information** | |
| 1. | | Details of interface | |
| | a) | Max. force at interface<br>- Tensile<br>- Compressive | |
| | b) | Tolerance on positioning of flanges | |
| | c) | Earthing arrangement | |
| 2. | | Minimum recommended clearance | |
| | a) | Between the cable | mm |
| | b) | Between the racks | mm |
| 3. | | Details of cable end sealing, cable clamping arrangement etc. | |
| 4. | | Details of cable handling, laying and pulling device | |
| 5. | | Weight and dimensions of shipping packages | |
| | a) | Name and shipping weight of the heaviest package of cable drums etc. | Kg |

Bidder's Name: .....

| | | | |
|---|---|---|---|
| | b) | Name and dimensions (LxBxH) of the largest package | m |
| | c) | Shipping weight of all special cable laying, handling devices, wrenches and tools etc. | |
| | d) | Shipping weight and dimensions of each XLPE cable end termination | |
| | e) | Maximum length of 220kV, single phase, single core of 400mm2 copper conductor XLPE insulated power cable which can be supplied in single length | m |
| | f) | Standard length | m |
| 6. | | Cable loading | |
| | i) | Continuous over loading at one go | |
| | ii) | Total hours of emergency to which cable can be loaded during its life | |

# SECTION 5

# ENCLOSURES TO SPECIFICATIONS

QUALITY ASSURANCE PLAN -Bidder shall follow the approved QAP of NTPC

ANNEXURE 2 SEA WORTHY PACKING FOR EXPORT JOBS, 3 SHEETS

**ANNEXURE-2**

# SEA WORTHY PACKING FOR EXPORT JOBS

## 1.0 SCOPE:

For export jobs, sea worthy packing capable of performing all necessary functions like prevention of damage to the contents, sufficient to support frequent handling and lengthy periods of outdoor storage in adverse weather conditions are required. Workmanship and material used shall meet the technical requirements and be in accordance with best commercial export packing practices. Vendor shall be responsible for the packing, however, it shall meet the minimum requirements specified herein. Equivalent or better packing methods may be deployed subject to approval of the purchaser. Vendor shall submit the packing procedure for its equipment for purchaser's approval during detailed engineering.

## 2.0 TECHNICAL SPECIFICATION OF WOOD:

The wood shall be Fir, Chir, Silver Oak (Grevillea Robusta) or chemically treated mango with moisture content not exceeding 50 %. The wood shall have flextural & compressive strength, stiffness, shock absorption and nail retention properties. The wood shall be free from common defects such as warp, bone, twist, knot, cracks, splits, end splits, bend, visible sign of infection and any kind of decay caused by insects, fungus etc. Surface cracks with a maximum depth of 3 mm are permissible. A continuous crack of any depth all along the length is not allowed.

The wood shall be chemically treated to provide protection against deterioration due to fungi and attack by termites, borers, marine organism and any other kind of infection. It shall be treated only after final processing like cutting, planing, joint grooving etc.

## 3.0 TYPE, DESIGN & DIMENSION OF WOODEN PACKING CASES:

## 3.1 PACKING OF EQUIPMENTS:

Various mechanical, electrical and C&I equipment e.g. pumps, motors, equipment skids, heat exchangers, control panels, switch gears, transformers etc. shall be wrapped in weather proof packing and then secured in wooden packing cases. The construction of wooden packing cases shall be as per details given below and also in figures 1 to 11.

### 3.1.1 BOTTOM FRAME:

The construction of bottom frame shall be as per fig. 2. The number of slides/runners for bottom frames shall be selected depending upon the weight and overall dimension of the load to be carried. The equipment shall be secured by fixing their base frame/plate with the help of bolt & nuts etc to the bottom frame of the wooden packing cases. The equipment not provided with the base frame/plate like cylindrical vessels etc. to be secured to the bottom frame of the wooden case with 'C' clamps fabricated from steel channels/angle irons.

### 3.1.2 TOP FRAME:

The construction of top frame shall be as per fig. 3.

### 3.1.3 END PANELS:

The dimensions of the end and lateral panels shall be calculated according to overall dimensions of the items to be packed.

Diagonal braces shall be used for packing cases having height exceeding 500 mm. Detail of bracing shall be as per figure 5 to 8.

### 3.1.4 SLING PLATE:

To facilitate lifting of cases, longitudnal under slide boards shall be fixed. To avoid damage to the

box while lifting sling plates shall be provided. Refer fig. 11.

### 3.1.5 ANGLE IRON CLEATS :

Angle iron cleats shall be used for strengthening the joints as indicated in fig. 10.

### 3.1.6 OTHER REQUIREMENTS:

The thickness of planks for top, bottom, side and end panels shall be atleast 25 mm. Planks used for this purpose shall be joined with each other by tongue & groove joint. The groove dimension shall be such that tongue fits tightly into groove to make good joint.

Runners/slides, traverse bars etc. shall be of single length i.e. without any joint. Planks for sheathing, diagonal bracing etc shall also be of single length upto 2400 mm. For sizes larger than 2400 mm, proper jointing is permitted for planks for sheathing and diagonal bracing.

Each equipment to be individually covered with double polyethylene petticoat. Sheet thickness of polyethylene sheet shall not be less than 0.175 mm (175 microns). The sealing shall be such so as not to allow moisture inside.

The inner surface of 4 sides of shooks shall be nailed with bituminised water proof kraft paper. Whereever 2 pieces of kraft paper are used, the joint shall have an overlap of minimum 20mm.

All the inner sides of the box shall be nailed with bitumen coated hessian polyethylene kraft paper. For top frame it shall project on all sides by 100mm and shall be nailed on sides. Wherever 2 pieces of kraft paper are used, the joint shall have an overlap of minimum 20mm.

For delicate equipment like control panels, switchgears etc suitable cushioning material like rubberized coir shall be provided on their bottom support. The thickness of coir shall be 50 mm (minimum) and width 100 mm (minimum).

For control panels and switchgears, the gap between the panel and casing shall be filled with rubberized coir with distance between consecutive supports less than 500 mm (reffig 15). For other equipment suitable support from sides of the casing to be provided.

Switchgear cubicles, control panels and control desks shall be packed and shipped in separate convenient sections. The components e.g. circuit breakers relays and instruments etc. which are removed from panels for shipping purpose shall be separately packed and shipped as per packing instructions in clause 3.2.

Packing case for control panels & switchgear panels shall be finally covered with GI sheet of minimum thickness of 0.4 mm.

Packing cases shall be bound at edges by nailing MS clamps/brackets at sufficient intervals. Further, heavier boxes shall be strapped with 'C' clamps (ref fig 4) fabricated from steel channels/angles and lighter boxes shall be strapped with hoop iron strips.

### 3.1.7 ALTERNATIVE PACKING CASES FOR CONTROL PANELS AND SWITCHGEARS

If required, for control and switchgear panels, construction of wooden packing cases may be provided as per fig 14 & 15 and as detailed below:

Thickness of planks for all sides, binding and jointing battens shall be atleast 25 mm. Width of planks shall be at least 125mm and that of binding and jointing planks shall be at least 100 mm.

Top frame shall be suitable so that it does not collapse due to sandwitching between slings while lifting. Longitudnal and traverse bars for the bottom wooden pallet to be suitably selected.

Diagonal bracings shall be as per clause 3.1.3 and All other requirements shall be as per clauses 3.1.4 to 3.1.6.

**3.2 PACKING OF LOOSE ITEMS:**

Loose mechanical, electrical and C&I items eg valves, fittings, pressure/temperature gauges/switches, circuit breakers, relays etc shall be individually wrapped using polyethylene sheets/U foam/thermocole sheets/air bubbled sheets depending upon the item and then packed in wooden boxes. The left out spaces and top of the boxes shall be filled with rubberized coir to get proper cushioning effect. Special attention is to be paid to relays, instruments etc for arresting the movement of their operating mechanisms during transportation.

The construction of wooden packing case shall be as per clause 3.1 retaining its all features concerning strength of box. The construction of wooden packing case for loose electrical and C&I items shall be as per fig. 16.

Inner surface of 6 sides of the box shall be lined with Bitumen coated hessian polyethylene kraft paper. Rubberized coir of min. 25 mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of the box.

Loose items such as Galvanised Steel Structure, Cable support racks, Cable Trays and GI Pipes etc. shall be individually wrapped using polyethylene sheets and further lots may be wrapped in Bitumen coated hessian cloth.

**4.0 MOISTURE ABSORBER:**

Silica gel is used for this purpose to protect contents over sufficiently long time from corrosion. Silica gel shall be of indicating type conforming to IS-304-1979 packed in cotton bags placed at different positions inside the packing for absorbing moisture and shall not come directly into contact with the equipment / material inside the package. The quantity of silica gel shall be enough for storage period of one (1) year, however, it shall not be less than 4 gms per litre volume of case subject to minimum of 400 gms per case.

**5.0 INDICATION MARKS ON THE BOXES:**

Markings shall be provided on the boxes indicating position of boxes for handling, storage and nature of consignment. For guidelines refer figure 12. The ink used for this purpose as well as for marking despatch instruction shall be indelible/nonwashable marking ink.

**6.0 DESPATCH DETAILS:**

External front and rear sides of the boxes to be planed for writing instructions.

Dispatch details such as consignor/consignee address, contract and case details, country of origin , port of delivery, stacking instructions shall be written on one of the side of boxes. An anodised aluminium plate shall be provided on one side of the boxes.

One copy of packing slip wrapped in polyethylene bag covered with aluminium packing slip holder to be nailed on the external surface of the box. One more copy of the packing slip wrapped in polyethylene bag to be kept inside the box at the prominent place.

**7.0 INSPECTION:**

There shall be a Customer Hold Point (CHP) for inspection of final assembly of packing. During above inspection, the records for Chemical Treatment shall be reviewed.

**- - x x - -**

# SECTION – 6
# CHECK LIST

## 1. TECHNICAL REQUIREMENTS FOR 220KV XLPE CABLES, CABLE SEALING END, ETC., COMPLETE IN ALL RESPECT ALONG WITH ACCESSORIES

| Sl. | Particulars | Reply by bidder. | |
|---|---|---|---|
| | | | |
| 1 | **TECHNICAL QUALIFYING REQUIREMENT** | | |
| 1.1 | The bidder should have designed, manufactured, supplied, erected/supervised erection and commissioning of at least 2.0 km of 220 kV or higher grade XLPE insulated cables. In one or more installations which should be in successful operation for at least two years as on date of bid opening. | Confirmed | Yes/No |
| 1.2 | The bid shall be submitted by the Manufacturer of the 220 kV Cable. The bidder's scope includes supply and services like installation, testing and commissioning. Bids submitted by agents will not be considered. | Confirmed | Yes/No |
| 1.3 | All the documents shall be submitted in English. Translated pages should be attested by the bidder. | Confirmed | Yes/No |
| | | | |
| 2 | **Un-priced Offer** –. | | |
| 2.1 | Confirm that all items have been quoted.<br>(If any item has not been quoted, the same shall be specifically brought out in Schedule of Technical Deviation) | Confirmed | Yes/No |
| 2.2 | The Specification envisages turnkey execution of a COMPLETE, POINT TO POINT, 220kV CABLE SYSTEM and the scope includes all materials and installation services ( including laying, supervision, termination, clamping, testing and commissioning of the cable system, point to point) necessary to execute the job to satisfaction of NTPC and BHEL. This includes all accessories required to complete the job in all respect. | Confirmed | Yes/No |
| 2.3 | Any other item /service required for the execution for the complete job is deemed to be included in the offer, whether specifically mentioned in the specification or not.<br>The Bill of quantities included in the offer shall clearly reflect such additional items along with their respective quantities and prices.<br>List of items required for completeness (Attach list, if required) | Additional items required | Yes/No |
| 2.4 | Support structure and foundation for cable termination shall be provided by BHEL based on the input (configuration, loads etc) provided by bidder. The erection of structure shall be done by BHEL. | Noted | Yes/No |
| 2.5 | The cable tunnel/trench and support structures/angles in the tunnel/trenches will be provided by BHEL as per detailed design and drawing provided by bidder. (It may be noted that the cable tunnel is in slope). The design of the cable support structures/angles in the cable tunnel and trench will be given by bidder. The supply and **initial** erection of cable supports shall be in BHEL scope. Changes to be made during cable laying and during cable jointing shall be in bidder's scope. The drawings shall also be given with bid especially for tunnel. | Confirmed. Drgs of cable support given alongwith bid | Yes/No |

| Sl. | Particulars | Reply by bidder. | |
|---|---|---|---|
| 2.6 | Terminal connector for overhead connection with cable sealing end shall be provided by BHEL. | Confirmed | Yes/No |
| 2.7 | Confirm that the consumables (list to be enclosed by bidder during contract stage) with shelf life of fewer than two years shall be supplied before erection after clearance from BHEL. | Confirmed | Yes/No |
| 3 | **Cable Lengths** | | |
| 3.1 | Manufacturing lengths and drum length shall be determined as per the joint route survey with NTPC /BHEL. | Confirmed | Yes/No |
| 3.2 | The Payment of cables length (for supply) will be as per approved quantities after joint survey. | Confirmed | Yes/No |
| 3.3 | The Payment of cables length (for installation) will be as per actual measurement at site which shall include margin for cable sealing end and two joints in future. | Confirmed | Yes/No |
| **4** | **Technical** | | |
| 4.1 | **Altitude :** The pothead yard is situated at an altitude of 1895 M above MSL, the equipment shall be suitable with increased insulation level (altitude correction factor of 1.1) and shall be suitable for operation under prescribed conditions.<br>*Bidder to inform what steps have been taken to ensure the same at bid stage.* | Writeup attached with bid. | Yes/No |
| 4.2 | **Sub-zero temperature** : The system shall be installed at site where temperature varies between (-) 20 °C to (+) 27 °C. The supplied equipment shall be suitable for operation under sub zero temp, with ice/snow considerations.<br>*Bidder to inform what steps have been taken to ensure the same at bid stage.* | Writeup attached with bid. | Yes/No |
| 4.3 | **Calculations** | | |
| 4.3.1 | Calculations – All calculations have been submitted alongwith configuration of cable laying in cable tunnel arrangement | Enclosed with bid | Yes/No |
| 4.3.2 | Continuous current rating of cable with under voltage condition along with overload<br>As per IEC:60287, thermal stresses in respect of short circuit current, external serving of cable, surrounding medium , etc., shall also be considered for current rating | Enclosed with bid | Yes/No |
| 4.3.3 | Bonding details and Sheath voltage calculations | Enclosed with bid | Yes/No |
| 4.3.4 | Calculation for sizing of metallic screen | Enclosed with bid | Yes/No |
| 4.4 | **Technical Deviations** | | |
| 4.4.1 | Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned elsewhere in the bid will not be considered. | Confirmed | Yes/No |
| 4.4.2 | Technical Deviation sheet has been submitted. | Confirmed | Yes/No |
| | | | |

| Sl. | Particulars | Reply by bidder. | |
|---|---|---|---|
| 5 | **Barchart** | | |
| 5.1 | Bidder will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning. | Confirmed | Yes/No |
| | | | |
| 6 | **Conditions** | | |
| 6.1 | The necessary power supply at site shall be provided by BHEL at one point only. | Noted | Yes/No |
| 6.2 | Cable Laying:<br>Provision of manpower in the grade of foreman and skilled technician, provision of laying supervisor, provision for laying tools and equipment, cable pulling, cut cable, place cable, supply of cable cleat, installation of cable cleat , etc. to complete. | Confirmed | Yes/No |
| 6.3 | Jointing and Termination:<br>Provision of Jointer and Jointing material, tools and Jointing and Terminating Scaffolding, cranes for lifting for the joints and sealing end materials, assemble of joint and sealing ends. Design of support structure for sealing end and joint, etc. to complete. | Confirmed | Yes/No |
| 6.4 | Store shall be provided by BHEL for cables and accessories. Confirm that the space required for the material being supplied, both indoor and outdoor has been indicated. | Details given with the bid. | Yes/No |
| 6.5 | Any tools and tackles and accessories required to complete the cable laying, termination and ETC shall be included in the offer. Please note BHEL shall not provide any equipment, tool and tackles for carrying out any test /or laying of cables. | Noted | Yes/No |
| 6.6 | Earthing of HT cables shall be in bidder scope. The items and accessories required for completeness of earthing at ends and joints but not limited to: Earthing cable, Bonding cable, Earth continuity cables, Link boxes etc as per the requirements.<br>Earth mat grid is existing and interconnected at both end (transformer cavern and pothead yard). Any special earthing required for cable jointing area inside cable tunnel like electrodes and other associated earthing material shall be supplied and installed by the bidder in the cable tunnel.<br>The complete earthing BOQ items and shall be clearly mentioned in the offer. | Details given with the bid. | Yes/No |
| 6.7 | Storage, warehouse for consumable material and returnable equipment, tools and tackles , office facilities & accommodation for your staff, Travel expenses for your staff, Transportation of all tools and equipment, Transportation of material tools and equipment between storage /warehouse and complete erection. | Confirmed | Yes/No |
| 6.8 | The entire installation , supply and erection of structure for cable sealing end is in your scope - BHEL will only provide constructed cable trench with installed cable support –Any accessories viz. support insulator between structure and cable sealing , clamps for fixing cable with structure, support insulator in cable trench, addition support at joints , etc. to complete the entire job shall be supplied by bidder at no | Confirmed | Yes/No |

| Sl. | Particulars | Reply by bidder. | |
|---|---|---|---|
| | extra cost. | | |
| 6.9 | Any damage in civil works during installation will be repaired by the bidder. | Confirmed | Yes/No |
| 7 | **Site Test** | | |
| 7.1 | Provision of test engineer, supply of all test equipment and arrangement like cranes (for lifting of cable drums, test equipment etc), all Test Equipment (DC voltage test equipment etc) for completion of total site work shall be in bidder's scope. | Confirmed | Yes/No |
| 7.2 | All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of the Employer as per cl.11.3 of Annexure-1, page 10 and 11. | Confirmed | Yes/No |
| 7.3 | No separate site test will be conducted by BHEL/Customer | Confirmed | Yes/No |
| | | | |
| 8 | **TYPE TESTS REQUIREMENTS** | | |
| 8.1 | The 220kV Cabling system (220 kV XLPE Cables, cable sealing end, etc., complete in all respect along with accessories) should have been type tested (as per relevant IEC 62067/ IEEE 48 standard).<br>The cable jointing kit and cable sealing end shall be of same make and type as that used in type test. | Confirmed | Yes/No |
| 8.2 | PQ test report for 220 kV cable system (1CX 400 sq.mm cable alongwith accessories like cable end terminations and cable joints etc) has been submitted with offer. Differences, if any, in the items offered and those which have been PQ tested shall be clearly brought out alongwith explanation for suitability. | Confirmed and enclosed with bid | Yes/No |
| 8.3 | Type test report for 220 kV cable system (1CX 400 sq.mm cable alongwith accessories like cable end terminations and cable joints etc) shall be submitted with the bid.<br>Differences, if any, in the items offered and those which have been Type tested shall be clearly brought out alongwith explanation for suitability.<br>Type test reports will be vetted by BHEL/ NTPC at contract stage and if the same is not acceptable to BHEL/ NTPC, bidder has to repeat type tests without any cost and delivery extension. | Confirmed and enclosed with bid | Yes/No |
| 8.4 | The testing shall have been done to take care of the higher requirement of dielectric for higher altitude (1895 M from MSL). They should be tested for these higher Impulse levels & higher one minute power frequency withstand voltage i.e. altitude correction factor 1.1 times of normal values | Confirmed | Yes/No |
| 8.5 | The Type Tests on 220kV System (XLPE Cables, cable joints, cable sealing end etc.) shall meet the requirements as per as per page 9 of Annexure-1, clause 12 of Section-2 and Quality Assurance Plan. | Confirmed | Yes/No |
| 8.6 | The test - reports submitted shall be of the tests conducted within last 10 (ten) years prior to the date of bid opening.<br>**Date of Bid opening is .** | Confirmed | Yes/No |
| 8.7 | In case the test reports are not found technically valid during contract stage by BHEL/ NTPC or if the tests were conducted earlier than 5 (five) years prior to the date of bid opening, the bidder shall repeat | Confirmed | Yes/No |

| Sl. | Particulars | Reply by bidder. | |
|---|---|---|---|
| | these test(s) at no extra cost to the purchaser and no delivery implication.<br>Technical valid - Any error or (any/all additional type tests not carried out) or discrepancy in the test reports vis-à-vis offered equipment due to any design / manufacturing changes (including substitution of components) or non-compliance with the requirement stipulated in the Technical Specification. | | |
| 8.8 | The PQ and type tests conducted earlier should have either been conducted in an accredited laboratory (accredited base on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located).<br>If the laboratory is not a national laboratory and member of STL, relevant papers of accreditation shall be submitted in English.<br>If the laboratory is in-house, the tests should have been witnessed by an independent agency. | Confirmed | Yes/No |
| 8.9 | The short circuit test should have been conducted in a laboratory which should be a member of STL (Short-Circuit Testing Liaison - www.stl-liaison.org). | Confirmed | Yes/No |
| 8.10 | The type test report shall be complete including list the test objects, photographs, oscillographs, test arrangement, drawing of tested objects (cables, accessories, etc), test connections.<br>The type test report shall be in English. If it is in any other language, it should include an English version (Translation shall be attested by the Bidder). The English version should be complete with measured values and conclusion. | Confirmed | Yes/No |
| | | | |
| **9** | **INSPECTION & TESTING** | | |
| 9.1 | Inspection and Testing shall be as per Annexure-1, page 9 and 10 and Quality Plan of NTPC in Section-5. Inspection and Testing shall be as per Annexure-1, page 9 and 10 and Quality Assurance Plan of NTPC in Section-5. | Confirmed | Yes/No |

## 2. TYPE TESTS

*TYPE TESTS FOR 220KV XLPE CABLES, CABLE SEALING END ETC., COMPLETE IN ALL RESPECT ALONG WITH ACCESSORIES*

| Sl. No. | TESTS | REPORT NO. | YES/NO |
|---|---|---|---|
| **A** | **Type tests** | | |
| | **Electrical type test on complete cable system as per IEC 62067 (Cl 12.4)** | | |
| 1. | Check for insulation thickness of cable for electrical type test (Cl 12.4.1) | | |
| 2. | Bending test (Cl 12.4.4) | | |
| 3. | Partial discharge test (Cl 12.4.4)<br>• at ambient temperature and<br>• at high temperature | | |
| 4. | Tan $\delta$ measurement (Cl 12.4.5) | | |
| 5. | Heating cycle voltage test (Cl 12.4.6) | | |
| 6. | Lightning impulse voltage test followed by p.f voltage voltage test (Cl 12.4.7.2) | | |
| 7. | Examination of cable system with cable and accessories (Cl 12.4.8) | | |
| 8. | Resistivity of cable semi-conducting screens (Cl 12.4.9) | | |
| | **Non electrical type test on cable components and on complete cable as per IEC 62067 (Cl 12.5)** | | |
| 9. | Check of cable construction (Cl 12.5.1) | | |
| 10. | Tests for determining the mechanical properties of insulation before and after ageing (Cl 12.5.2) | | |
| 11. | Tests for determining the mechanical properties of oversheaths before and after ageing (Cl 12.5.3) | | |
| 12. | Ageing tests on pieces of completed cable to check compatibility of materials (Cl 12.5.4) | | |
| 13. | Hot set test for XLPE insulation (Cl 12.5.10) | | |
| 14. | Measurement of density of HDPE insulation (Cl 12.5.11) | | |
| 15. | Measurement of carbon black content of black PE oversheaths ($ST_3$ and $ST_7$, see 12.5.12) | | |
| 16. | Test under fire conditions (Cl 12.5.13) | | |
| 17. | Water penetration test (Cl 12.5.14) | | |
| 18. | Tests on components of cables with a longitudinally applied metal tapeor foil, bonded to the oversheath | | |

# BHARAT HEAVY ELECTRICALS LIMITED
## TRANSMISSION PROJECTS ENGINEERING MANAGEMENT
### NEW DELHI

| | | | | | |
|---|---|---|---|---|---|
| DOCUMENT No. | TB-358-316-002 | Rev 00 | Prepared | Checked | Appd |
| TYPE OF DOC. | TECHNICAL SPECFICATION | NAME | MM | DKM | RS |
| 220 KV XLPE Cable & Accessories | | SIGN | | | |
| | | DATE | 28/3/14 | 04/04/14 | 04/04/14 |
| | | GROUP | TBEM | | |
| | | W.O. No | | | |

| | |
|---|---|
| CUSTOMER/ CONSULTANT | NTPC Hydro Ltd. |
| PROJECT | Lata Tapovan Hydro Electric Project (3 X 57 MW) |



**Contents:**



**Note: Checklists for Section-1 (Annexure-I) & Section-6 will be submitted alongwith offer. Offers without checklist will not be evaluated.**

| Rev | Date | Altered | Checked | Approved | |
|---|---|---|---|---|---|
| | | | | | |
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# SECTION 1
# SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

## 1.0 SCOPE

The scope covers the supply and services required for the comprehensive functional system covering 220kV XLPE Cables, cable terminations end, cable joints, accessories etc. for interconnecting two line bays between GIS and pothead yard ( 2 cable runs per phase in parallel).

This technical specification covers the requirements of design, manufacturing, quality assurance, quality control, shop assembly, testing at works, packing and dispatch, transporting, supervision of unloading, installation (including laying of cable at site in BHEL provided tunnel/trench), commissioning, performance and acceptance testing, training at site of complete 220kV XLPE Cable system (Cables, cable terminations, earthing, link boxes etc.) complete in all respect along with accessories.

This section covers the specific technical requirements.

In case of any discrepancies between the requirements mentioned in this section and those specified in the following sections of this specification, the specifications given herein shall prevail and shall be treated as binding requirements.

The equipment is required for the following project:

a) Project name : : **Lata Tapovan Hydro Electric Project (3 x 57 MW)**
b) Customer name : **NTPC Hydro Ltd.**
c) Main Contractor : **BHEL**

Refer Section - 3 for Project Details and General Specifications.

## 1.1 General

It may be noted that:

- Any cable or accessories damage during laying will be repaired/replaced by bidder. Cable joints shall not be permitted.
- Store will be provided by BHEL. Bidder to provide their requirement of space in open and closed store during tender stage.
- The exact length shall also be decided by supplier after visiting site & making precise measurements at contract stage. Manufacturing lengths and drum length shall be determined as per the joint route survey with NTPC/BHEL.
    - The Payment of cables length (for supply) will be as per approved quantities after joint survey.
    - The Payment of cables length (for installation) will be as per actual measurement at site which shall also include cable terminations.
- Support structure and foundation for cable termination in potheadyard shall be provided by BHEL based on the design input (configuration, loads etc) provided by supplier.
- The necessary power supply at site shall be provided by BHEL at one point only.
- Terminal connector for overhead connection with cable sealing end shall be provided by BHEL.
- The cable trench and support structures/angles in the tunnel & trenches will be supplied by BHEL as per detailed design and drawing provided by bidder (It may be noted that the cable tunnel is in slope). The typical drawings for reference shall also be given with bid especially for tunnel.

- Cable Laying: Provision of manpower in the grade of foreman and skilled technician, provision of laying supervisor, provision for laying tools and equipment, cable pulling, cut cable, place cable, supply of cable cleat, installation of cable cleat etc. to complete is deemed to be included in scope.

- Termination: Provision of Jointer and Jointing/termination material, tools and Jointing and Terminating Scaffolding, cranes for lifting for the joints and termination materials, assembly of joint and sealing ends.

- Site Test: Provision of test engineer, supply of all test equipment and arrangement like cranes etc. AC voltage test of insulation with voltage of Uo (complying with IEC 62067) etc. for completion of total site work. AC supply shall be arranged by BHEL/NTPC from nearby grid.

- Any other tools and tackles and accessories required to complete the cable laying, termination and ETC shall be included in the offer. Please note BHEL shall not provide any equipments, tool and tackles for carrying out any test /or laying of cables.

- Bidder to submit list of consumables with shelf life of less than two years. Erection as per L2 scheduler enclosed It shall be supplied before erection after clearance from BHEL.

- Supplier will submit detailed bar chart indicating all the milestones from Engineering till manufacturing/ testing, dispatch to site and commissioning.

## 1.2 General project details :

Lata Tapovan Hydro Electric Project is a run of the river scheme across the river Dhauliganga in the district of Chamoli. The scheme involves construction of barrage on river Dhauliganga near village Lata with 4.8 m diameter, 7.3 Km. long horse shoe shaped HRT, 305.5 m long tailrace tunnel and underground power house. The installed capacity of the project is 171 MW (3x57 MW). The geo-coordinates of barrage site at Lata Tapovan is Longitude 70° 43'5"and Latitude 30°31'5" .

The synchronous generators are proposed to be connected to single phase Generator Transformers(11/230/√3kV) through isolated phase bus ducts and Generator Circuit Breakers housed in the interconnecting tunnels between Power House cavern & transformer cavern. The HV terminals of Generator Transformers will be connected with the 220 kV GIS located on a floor above the transformer hall through bus duct.

The connection between 220 kV GIS and 220 kV Air Insulated pot-head yard will be through 220 kV XLPE cables. Power from the project will evacuated through two nos. 220 kV lines to proposed Joshimath Substation.

## 1.3 SPECIFIC TECHNICAL REQUIREMENTS

- **Altitude :** The GIS will be placed in a cavern at an altitude of 1819m above MSL, and the pothead yard will be at 1895m above MSL. The equipment shall be suitable for operation under prescribed conditions. *Bidder to inform what steps have been taken to ensure the same at bid stage especially for outdoor termination kit. Bidder to give calculation for altitude correction or give justification..*
- **Sub-zero temperature :** The equipment being supplied shall be suitable for operation under sub zero temp - temperature variation between -20 °C to + 27 °C. Design Ambient shall be 40°C. *Bidder to inform what steps have been taken to ensure the same at bid stage.*

| Sl.No. | Particulars | Value |
|---|---|---|

| Sl.No. | Particulars | Value |
|---|---|---|
| | **Cable construction** | |
| 1 | Type of Cables | Cross-linked polyethylene insulated |
| 2 | No. of Cores | Single. |
| 3.1 | Conductor size | 400 sq. mm |
| 3.2 | Conductor material | Copper |
| 3.3 | Shape | Compacted Circular |
| 4 | Conductor Screen | Extruded semi conducting compound |
| 5 | Insulation Material | Extruded Cross Linked poly Ethylene (XLPE) |
| 6 | Insulation Screen | Extruded semi conducting compound |
| 7 | Bedding | Layer of swellable semi conducting tape(s) to form water barrier over semiconducting screen & over copper wire screen (if applicable) |
| 8 | Metallic Sheath | Aluminium or lead with copper wires screen and copper binder tape as per requirement |
| 9 | Outer Sheath | Flame retardant Polyethylene (PE) /FRLS PVC with overall semiconducting/graphite compound |
| | **System Parameters (excl. Altitude Correction factor)** | |
| 1 | Normal system voltage | 220KV |
| 2 | Maximum system voltage | 245kV |
| 3 | Rated Short Circuit Withstand Current at a rated voltage for 1 second | 40kA r.m.s |
| 4 | Dynamic Short Circuit Withstand Current | 100 kA(peak) |
| 5 | System frequency | 50hz |
| 6 | Frequency variation | +3% to -5% |
| 7 | Rated continuous Current | 650 Amp. For one run of cable |
| 8 | Overload capacity | Nil |
| 9 | Maximum allowable temperature for cable and accessories. | As per IEC |
| 10 | Operating Temperature of conductor: | |
| a) | Maximum permissible temperature during normal operation under combined effect of ambient and maximum load | 90 deg C |
| b) | Maximum permissible temperature during short circuit under combined effect of ambient and maximum load (with conductor temperature at inception of short circuit as 90 deg. C). | 250 deg C |
| 11 | Basic impulse insulation level (1.2/50 micro second wave) | 1050 kV (peak) |
| 12 | Power frequency withstand voltage | 460 kV |
| 13 | **Creepage** | 25mm/kV |
| | **Laying conditions** | |
| (a) | Laid on cable racks in cable trench with suitable spacing between cables | 2d mm centre to centre (typical) where "d" is overall diameter of finished cable |
| (b) | Earthing of screen | |

| Sl.No. | Particulars | Value |
|---|---|---|
| | -GIS end | Solidly earthed link box (CCPU) without SVL (sheath voltage limiter). |
| | -Pothead yard end | Solidly earthed link box (CCPU) with SVL (sheath voltage limiter) |
| (c) | Ambient air temp. | 40 deg. C |
| (d) | Type of atmosphere | Heavily polluted |

Checklist for Cable and Cable Construction is attached with this Section **(Annexure-I).** Filled up Checklist for Cable and Cable Construction shall have to be furnished along with the offer.

Details of site shall be as per following Drawings:

| Sl. no. | Description | Drawing/Sketch No. |
|---|---|---|
| 1 | Pothead Yard and Cable tunnel details | 5601-002-P-E-C-A-531 |
| 2 | Transformer and GIS Cavern General Arrangement Plans | 5601-002-P-E-C-A-528 Rev 02 |
| 3 | Plan off Power House Complex General Layout Plan | 5601-003-P-E-C-A-513 Rev 04 |
| 4 | Transformer & GIS Cavern Sections 1-1 to 4-4 | 5601-002-P-E-C-A-529 rev 02 |

**1.4 Provenness criteria for other equipments/ Systems**

- The bidder should have designed, manufactured, supplied, erected/supervised erection and commissioning of at least 2.0 km of 220 kV or higher grade XLPE insulated cable. In one or more installations which should be in successful operation for at least two years as on **17.09.2012.**
- For services, Participation by companies from China, Pakistan, Bangladesh either direct or by proxy is not acceptable.

**1.5 QUANTITIES:**

Material and Services required for the execution of the job are listed below. All item listed in the following BOQs shall be offered. Any item not appearing herein but required for completeness of the job is deemed to be included in the scope.

**As per Annexure-II**

**Notes:**

(1) The un-price BOQ shall be strictly as per ANNEXURE-II.

(2) Manufacturing lengths and drum length shall be determined as per the joint route survey with NTPC/BHEL, may increase/decrease as per requirement.

(3) The exact length may vary by -20% to +20% at Contract Stage based on actual measurement at site and calculations submitted by the bidder. Individual quantity of other items may vary to any extent and may get deleted during contract/execution stage.

(4) Earthing of HT cables shall be in supplier scope. Earth mat grid exists at both ends (transformer cavern and pothead yard) and will be interconnected. The accessories shall necessarily include the following but not limited to: Earthing cable, earth continuity cables etc as per the requirements. Any special earthing required shall be supplied and installed by the bidder in the cable tunnel. The complete earthing BOQ items shall be clearly mentioned in the offer.

(5) Earthing and Link Box: Design of support structure for link box, earthing cable, installation of link box, installation of earthing cable, connection of bonding cable, etc. to complete is deemed to be included in bidder's scope.

**OTHER SERVICES FOR CABLES:**

The specification envisages turnkey execution of a COMPLETE, POINT TO POINT, 220kV CABLE SYSTEM and the scope includes services (including laying, supervision, termination, clamping, testing and commissioning of the cable system) necessary to execute the job to satisfaction of NTPC Hydro and BHEL.

Any other item /service required for the execution for the complete job shall be included in the offer, whether specifically mentioned in the specification or not.

**Bids in which only Supplies or only Installation Services are offered shall be rejected.**

### 1.5.1 220KV XLPE CABLE CALCULATIONS DOCUMENT TO BE SUBMITTED:

1.5.1.1 AT TENDER STAGE:

Bidder to submit the detailed design calculations of 220kV XLPE cables for
Flat formation for 3 phases (in Transformer Cavern).

(a) Bonding details and Sheath voltage calculations
(b) Continuous current rating of cable with under voltage condition along with overload.
As per IEC:60287, thermal stresses in respect of short circuit current, external serving of cable, surrounding medium , etc., shall also be considered for current rating
(c) Calculation for sizing of metallic screen
(d) Configuration design of cable laying shall be shown.

1.5.1.2 DURING DETAILED ENGINEERING:

Document schedule as per **Annexure-III**

### 1.6 TYPE TESTS REQUIREMENTS

The 220kV Cabling system (220 kV XLPE Cables, cable sealing end, cable joints etc., complete in all respect along with accessories) should have been type tested (as per relevant IEC 62067.

They should be tested for these higher Impulse levels & higher one minute power frequency withstand voltage taking into account altitude correction factor to take care of the higher requirement of dielectric for higher altitude (1895 M from MSL).

The bidder shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. **The bidder shall indicate the charges for type tests in the boq** and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by BHEL/NTPC's engineer.

The type tests shall be carried out in presence of the Employer's representative, for which minimum 45 days notice shall be given by the contractor. The contractor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

In case the bidder has conducted such specified type test(s) within last ***ten*** **years** as on **17.09.2012**, he may submit *during detailed engineering* the type test reports for waival of conductance of such type test(s). These reports should be for the tests 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 a client. The owner reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these & extra cable lengths required for testing shall be deemed to be included in the equipment price.

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of the Employer, 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.

**1.7 INSPECTION & TESTING**

Prior to dispatch, the routine & acceptance tests shall be carried out on cables and accessories in accordance with the applicable IEC /IS and the material shall be offered for final inspection by BHEL and NTPC Hydro in accordance with quality assurance plan.

Inspection and Testing shall approved Quality Assurance Plan

**1.8 QUALITY PLAN**

The contractor shall carry out the works in accordance with sound quality management principles which shall include such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Contractor shall submit detailed Quality Plan for BHEL / customer's approval.

**1.9 FIELD TESTS**

All field tests including tests during installation, pre-commissioning, commissioning, field acceptance tests shall be conducted by the Contractor, in presence of representative of BHEL/NTPC Hydro.

Procedure to be adopted for conducting the operational, pre-commissioning, commissioning, performance and field acceptance test shall be submitted well in advance, at least six months before start of relevant testing, for approval by the NTPC Hydro.

Annexure-I

Cables and Accessories - 220 kV XLPE Power Cables

## CHECK LIST FOR CABLE

| Sl. no. | Particulars | Unit | Requirement | As per Offer of Bidder | As per Type Test Report of Bidder | As per PQ Test Report of Bidder |
|---|---|---|---|---|---|---|
| 1. | Conformance to standard | | IEC 62067 | | | |
| 2. | Rated System Voltage | $kV_{RMS}$ | 220 | | | |
| 3. | Highest System Voltage | $kV_{RMS}$ | 245 | | | |
| 4. | System earthing | | Effectively earthed (solidly grounded) | | | |
| 5. | System fault current for one second for conductor | kA | 40 | | | |
| 6. | System fault current for one second for screen | kA | 40 | | | |
| 7. | One minute power frequency withstand voltage | $kV_{RMS}$ | 460 kV rms + Alt. Correction Factor | | | |
| 8. | Rated lightning impulse withstand voltage (1.2/50µs) | $kV_{PEAK}$ | ± 1050 kVp+ Alt. Correction Factor | | | |
| 9. | 15 min dry power frequency withstand test voltage (conductor-sheet) | $kV_{RMS}$ | 318 | | | |
| 10. | Continuous Current rating (considering 10% overloading of Transformer and 10% under voltage condition) | A | 650/Cable + Alt. Correction Factor | | | |
| 11. | Creepage distance for cable sealing end | mm/kV | 25 (min.) | | | |
| 12. | Maximum permissible operating temperature of the conductor under | | | | | |
| | Rated continuous current | °C | 90 | | | |
| | Short circuit condition | °C | 250 | | | |
| | Short time emergency (overload) operation | °C | | | | |
| 13. | Capacitance per phase | nF/km | | | | |
| 14. | Total cable losses at rated current considering proposed screen earthing | | | | | |
| | Per phase | kW/km | | | | |
| | Complete 3 phase system | kW/km | | | | |
| 15. | Sheath Voltage under full load conditions at terminations, voltage to ground | V | | | - | - |
| 16. | Max PD | pC | | | | |
| 17. | EHV Cable | | | | | |
| | EHV Cable – Make | | | | | |

Annexure-I

Cables and Accessories - 220 kV XLPE Power Cables

| Sl. no. | Particulars | Unit | Requirement | As per Offer of Bidder | As per Type Test Report of Bidder | As per PQ Test Report of Bidder |
|---|---|---|---|---|---|---|
| | EHV Cable – Type | | | | | |
| | EHV Cable – Address of Works | | | | | |
| **18.** | **Cable Termination Kit-outdoor** | | | | | |
| | Cable Termination Kit– Make | | | | | |
| | Cable Termination Kit– Type | | Oil filled/ SF6 insulated | | | |
| | Cable Termination Kit– Address of Works | | | | | |
| | Characteristics as per IEC 62067 – Assembly technique etc | | | | | |
| | Housing of Outdoor Cable Termination Kit | | Composite/ Porcelain suitable for use with SF6/oil | | - | - |
| **19.** | **Cable Termination Kit- indoor** | | | | | |
| | Cable Termination Kit– Make | | | | | |
| | Cable Termination Kit– Type | | SF6 insulated | | | |
| | Cable Termination Kit– Address of Works | | | | | |
| | Characteristics as per IEC 62067 – Assembly technique etc | | | | | |
| | Housing of Indoor Cable Termination Kit | | Epoxy/ Porcelain suitable for use with SF6 | | - | - |
| **20.** | **Cable Joint** | | | | | |
| | Cable Joint– Make | | | | | |
| | Cable Joint– Type | | | | | |
| | Cable Joint– Address of Works | | - | | | |
| | Characteristics as per IEC 62067 – Assembly technique etc | | | | | |

CHECK LIST FOR CABLE CONSTRUCTION

| Sl. no. | Particulars | Unit | Requirement | As per Offer of Bidder | As per Type Test Report of Bidder | As per PQ Test Report of Bidder |
|---|---|---|---|---|---|---|
| **1** | **Conductor** | | | | | |
| 1.1 | Conductor area | $mm^2$ | 400 | | | |
| 1.2 | Material | | Stranded Copper | | | |

Annexure-I

Cables and Accessories - 220 kV XLPE Power Cables

| Sl. no. | Particulars | Unit | Requirement | As per Offer of Bidder | As per Type Test Report of Bidder | As per PQ Test Report of Bidder |
|---|---|---|---|---|---|---|
| 1.3 | Construction | | Compacted circular | | | |
| 1.4 | DC Resistance at 20°C | Ω | | | - | - |
| 1.5 | AC Resistance at 20°C | Ω | | | - | - |
| 1.6 | Nature of measures taken to reduce skin effect | | | | | |
| 1.7 | Nature of measures taken to achieve longitudinal Water tightness | | | | | |
| | **Conductor screen** | | Extruded semiconducting compound | | | |
| **2** | **Insulation** | | | | | |
| 2.1 | Material | | XLPE | | | |
| 2.2 | Nominal Thickness & Tolerance | mm | As per IEC & Type test reports | | | |
| 2.4 | Includes Conductor screen and insulation screen XLPE Semi-conducting layer | | Triple Extrusion Process | | | |
| 2.5 | Type of manufacturing process for insulation system | | | | | |
| **3** | **Bedding** | | Layer of swellable semi-conducting tape(s) to form water barrier. | | | |
| **4** | **Metallic Sheath** | | | | | |
| 4.1 | Material | | Al. or Lead with copper wires screen and copper binder tape | | | |
| 4.2 | Screen Cross-section | $mm^2$ | | | | |
| 4.3 | Construction - Thickness | | | | | |
| **5** | **Outer sheath** | | | | | |
| 5.1 | Material | | Extruded Flame retardant PE/FRLS PVC outer sheath with overall semi conducting / graphite coating | | - | - |
| 5.2 | Nominal Thickness & Tolerance | mm | | | | |
| 5.3 | | | | | | |
| **7** | **Cable** | | | | | |
| 7.1 | Nominal capacitance, corrected to 1 km length, | nF/km | | | | |

Annexure-I

Cables and Accessories - 220 kV XLPE Power Cables

| Sl. no. | Particulars | Unit | Requirement | As per Offer of Bidder | As per Type Test Report of Bidder | As per PQ Test Report of Bidder |
|---|---|---|---|---|---|---|
| | between conductor and metal screen/sheath | | | | | |
| 7.2 | Calculated nominal electrical stress at conductor screen ($E_i$) | | | | | |
| 7.3 | Calculated nominal electrical stress at insulation screen ($E_o$) | | | | | |
| 7.4 | Min Bending Radius | | | | | |
| 7.5 | Weight of cable | Kg/m | | | | |
| 7.6 | OD | | | | | |
| | | | | | | |

**Project : Lata Tapovan Hydro Hydro Electric project (3x57 MW)**

BOQ for 220 kV HT Cable and its accessories

Annexure-II
Rev-00

| Sl. no. | Description | Detailed description | Unit | Qty. |
|---|---|---|---|---|
| A | **Main items** | | | |
| 1 | Supply item - 220kV XLPE, 1C,400 sqmm cable (14 lengths including 2 spare lengths) | route length = 250 m | M | 14x250=3500 |
| 2 | Supply item -220kV XLPE 1C,400 sqmm Cable Complete indoor cable termination at GIS end | 220kV cable sealing end (indoor type) suitable for terminating the cables for interconnection with GIS including accessories like necessary hardware excluding terminal connector | Nos. | 12 |
| 3 | Supply item -220kV XLPE 1C,400 sqmm Cable Complete outdoor cable termination at Pot head yard end | 220kV cable **sealing end** (outdoor type) suitable for terminating the cables at pothead yard end including all accessories like necessary hardware, clamps for fixing on structure etc (including terminal connector) | Nos. | 12 |
| 4 | Supply item -3x1-phase Earthing link box with SVL (sheath voltage limiter) including all cable/cable accessories required for the connection (1 set for 3x1-ph cable) | | Set | 4 |
| 5 | Supply item - 3x1-phase Earthing link box without SVL (sheath voltage limiter) including all cable/cable accessories required for the connection (1 set for 3x1-ph cable) | | Set | 4 |
| 6 | Supply item - Earthing of 220 kV XLPE cable as per requirement detailed in Note.4 & 5 of clause 1.5, including earthing / bonding cable as required (1 lot is for 3 phase (2 cable runs for each phase)) | | Lot | 2 |
| 7 | Supply item - Non magnetic, Single type cleats & spacers for fixing 1 No. 220kV cable in flat formation on cable racks (Cable trays are not envisaged) | | lot | 14 |
| 8 | Supply item - Consumables having limited shelf life required during erection, testing and commissioning. (1 lot is for complete package) | | Lot | 1 |
| B | **Mandatory spares** | | | |
| 9 | Supply item -Complete indoor cable termination at GIS end | 220kV XLPE 1C,400 sqmm cable termination (indoor type) suitable for terminating the cables for interconnection with GIS including accessories like necessary hardware excluding terminal connector | Nos. | 2 |
| 10 | Supply item -Complete outdoor cable termination at Pot head yard end | 220kV XLPE 1C,400 sqmm cable **termination** (outdoor type) suitable for terminating the cables at pothead yard end including all accessories like necessary hardware, clamps for fixing on structure etc (including terminal connector) | Nos. | 2 |
| 11 | Supply item - Cable straight through joints complete with all necessary fittings and installation material | 220kV XLPE Cable straight through joints complete with all necessary fittings and installation material | Set | 2 |
| 12 | Supply item - 3x1-phase Earthing link box with SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | | Set | 2 |
| 13 | Supply item - 3x1-phase Earthing link box without SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | | Set | 2 |

**Project : Lata Tapovan Hydro Hydro Electric project (3x57 MW)**

BOQ for 220 kV HT Cable and its accessories

Annexure-II
Rev-00

| Sl. no. | Description | Detailed description | Unit | Qty. |
|---|---|---|---|---|
| 14 | Supply item - Sheath Voltage Limiter | Supply item - 220kV XLPE 1C,400 sqmm Cable Sheath Voltage Limiter | Nos. | 3 |
| C | **Services** | | | |
| 15 | Services - Installation of 220kV XLPE, 1C,400 sqmm cable including two spare cables (14 lengths) | | M | 3500 |
| 16 | Services - Installation of 220kV XLPE 1C,400 sqmm Cable Complete indoor cable termination at GIS end | | Nos. | 12 |
| 17 | Services - Installation of 220kV XLPE 1C,400 sqmm Cable Complete outdoor cable termination at Pot head yard end | | Nos. | 12 |
| 18 | Services - Installation of 3-phase earthing link box with SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | | Set | 4 |
| 19 | Services - Installation of 3-phase earthing link box without SVL (sheath voltage limiter) including all cable/cable accessories required for the connection | | Set | 4 |
| 20 | Services -Earthing of 220 kV XLPE cable as per requirement (1 lot=3 cables, 2 runns for each phase) | | Lot | 2 |
| 21 | Services - Installation of Non magnetic, Single type cleats for fixing 1 No. 220kV cable in flat formation on cable racks (Cable trays are not envisaged) | | Lot | 14 |
| 22 | Services - Training During erection/installation/site work (6 NTPC/BHEL Engineers at site -1 day) | Details of training as per clause 25.03.00, Annexure-V, Section 3. | Lot | 1 |
| 23 | Services - Training during testing & commissioning at site (6 NTPC/BHEL engineers - 1 day) | Details of training as per clause 25.03.00, Annexure-V, Section 3. | Lot | 1 |
| 24 | Services - Field Testing & Commissioning of 220 kV Cables | | Nos. | 14 |
| 25 | Services - AC Voltage Test for insulation with voltage of Uo for 24 hrs ( 1 Lot for 1 **circuit)** | | Lot | 2 |
| 26 | Services - Route Survey for laying of 220kV cable at Lata Tapovan Site | | Lot | 1 |
| 27 | **Electrical type test on complete cable system as per IEC 62067 (Cl 12.4)** | Charges for type test will be paid only if the tests are conducted & the type test reports are acceptable and BHEL insists on repeating the same. BHEL reserves the right to conduct or waive the the conducting of type tests. | Lot | 1 |
| 28 | **Non electrical type test on cable components and on complete cable as per IEC 62067 (Cl 12.5)** | Charges for type test will be paid only if the tests are conducted & the type test reports are acceptable and BHEL insists on repeating the same. BHEL reserves the right to conduct or waive the the conducting of type tests. | Lot | 1 |

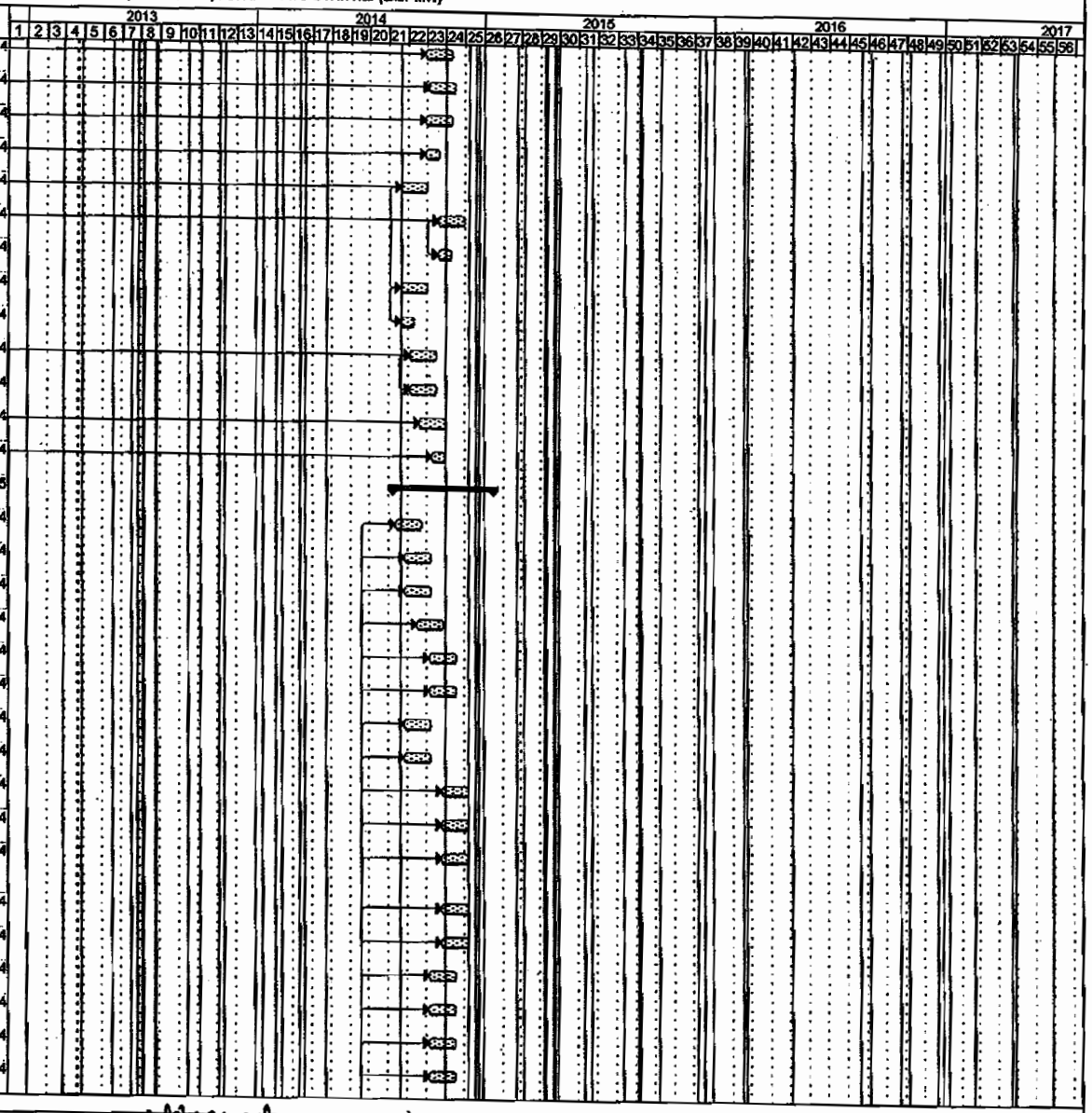
| Sl. No. | NTPC_DRG_NO. | DRAWING TITLE | PURPOSE (A/I) |
|---|---|---|---|
| 1 | 5601-003-H211-PVE-Y-033 | Drawing and Technical Data Sheet for 220 KV Cable | A |
| 2 | 5601-003-H211-PVE-Y-034 | 220 KV Cable sizing & Selection | A |
| 3 | 5601-003-H211-PVE-Y-035 | 220KV Cable GIS termination drawing & Technical Data Sheet | A |
| 4 | 5601-003-H211-PVE-Y-036 | 220KV Cable Outdoor Termination drawing & Technical Data Sheet | A |
| 5 | 5601-003-H211-PVE-Y-037 | Bonding cable drawing & Technical Data Sheet for 220KV Cable system | A |
| 6 | 5601-003-H211-PVE-Y-038 | Bonding cable sizing & selection | A |
| 7 | 5601-003-H211-PVE-Y-039 | 220KV Cable - Earthing Link Box drawing including Lightning arrester & Technical Data Sheet for both types (with & without SVL) | A |
| 8 | 5601-003-H211-PVE-Y-040 | 220KV Cable Fixing clamp drawing & Technical Data Sheet | A |
| 9 | 5601-003-H211-PVE-Y-041 | 220KV Cable Drums details | A |
| 10 | 5601-003-H211-PVE-Y-042 | 220KV Circuit earthing drawing | A |
| 11 | 5601-003-H211-PVE-B-043 | General Cable Support drawing with Four horizontal supports including hardware & inserts etc for 220KV Cables | A |
| 12 | 5601-003-H211-PVE-B-044 | General Cable Support drawing with Two horizontal supports including hardware & inserts etc - 220KV Cables | A |
| 13 | 5601-003-H211-PVE-B-045 | Outdoor Termonation Support Structure drawing at the pothead yard including hardware, inserts & foundation at Potheadyard - 220KV Cables | A |
| 14 | 5601-003-H211-PVE-B-046 | GIS Termination Support Structure drawing at GIS hall indoor Termination including hardware, inserts & foundation at GIS - 220KV Cables | A |
| 15 | 5601-003-H211-PVE-B-047 | Special Cable support structures drawing 220KV Cables | A |
| 16 | 5601-003-H211-PVE-F-048 | 220KV Cables Layout in GIS Hall | A |
| 17 | 5601-003-H211-PVE-F-049 | 220KV Cables Layout in Cable Tunnel | A |
| 18 | 5601-003-H211-PVE-F-050 | 220KV Cables layout in Pothead yard | A |
| 19 | 5601-003-H211-PVE-F-051 | Layout and cable installation drawing - 220KV Cables | A |
| 20 | 5601-003-H211-PVE-U-052 | Cable and Accessories load on civil work in GIS Hall, Cable Tunnel & Potheadyard - 220KV Cables | A |
| 21 | 5601-003-H211-PVE-U-053 | Calculation of cable continuous rated current - 220KV Cables | A |
| 22 | 5601-003-H211-PVE-U-054 | Calculation of cable short circuit current - 220KV Cables | A |
| 23 | 5601-003-H211-PVE-U-055 | Cable loss calculation - 220KV Cables | I |
| 24 | 5601-003-H211-PVE-U-056 | Electrodynamic force calculation in short circuit - 220KV Cables | I |
| 25 | 5601-003-H211-PVE-U-057 | Cable Mechanical strength calculation -220KV Cables | I |
| 26 | 5601-003-H211-PVE-U-058 | Overvoltage calculation of cable sheath protection -220KV Cables | I |
| 27 | 5601-003-H211-PVE-U-059 | Calculation of pulling force and side pressure during cable laying and installation -220KV Cables | I |

| Sl. No. | NTPC_DRG_NO. | DRAWING TITLE | PURPOSE (A/I) |
|---|---|---|---|
| 28 | 5601-003-H211-PVE-U-060 | Structure Design calculations for Cable Supports (in GIS Hall, Cable tunnel & Pothead yard)- 220KV Cables | A |
| 29 | 5601-003-H211-PVE-U-061 | Calculation of cable length -220KV Cables | I |
| 30 | 5601-003-H211-PVE-X-062 | Cable drum handling and storage- 220KV Cables | I |
| 31 | 5601-003-H211-PVE-X-063 | Storage of Termination & other material - 220KV Cables | I |
| 32 | 5601-003-H211-PVE-X-064 | Cable installation -220KV Cables | I |
| 33 | 5601-003-H211-PVE-X-065 | GIS termination Assembly & Erection- 220KV Cables | I |
| 34 | 5601-003-H211-PVE-X-066 | Outdoor termination Assembly & Erection- 220KV Cables | I |
| 35 | 5601-003-H211-PVE-X-067 | Operation and Maintenance Procedure- 220KV Cables | I |
| 36 | 5601-003-H211-PVE-Q-068 | Manufacturing Quality plan for 220KV Cables, Accessories & Support structures | A |
| 37 | 5601-003-H211-PVE-W-069 | Type Test Procedure for 220KV Cable & Accessories | A |
| 38 | 5601-003-H211-PVE-W-070 | Type Test Reports for 220KV Cables & Accessories | A |
| 39 | 5601-003-H211-PVE-W-071 | Type Test Reports for Bonding Cable for 220KV cables | A |
| 40 | 5601-003-H211-PVE-G-072 | Field Quality Plan- 220KV Cables | A |
| 41 | 5601-003-H211-PVE-W-073 | Commissioning Test Procedure -220KV Cables | A |
| 42 | 5601-003-H211-PVE-U-074 | Structure Design Calculation for Support for Outdoor Cable Termination- 220KV Cables | A |

ANNEXURE - IV

PROJECT SCHEDULE L-2 NETWORK (REVISION-01) FOR LATA TAPOVAN HEP(3x57 MW)

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1125 | GA Drawing of Inverter System (A) | 42 days | Tue 30-09-14 | Mon 10-11-14 |
| 1126 | Design philosophy of fire detection and protection system (A) | 42 days | Sun 05-10-14 | Sat 15-11-14 |
| 1127 | Technical data sheet of fire detection & protection system (ITEMS/ | 42 days | Tue 30-09-14 | Mon 10-11-14 |
| 1128 | GA drawing of fire detection and protection system equipements (I) | 21 days | Tue 30-09-14 | Mon 20-10-14 |
| 1129 | P & I Diagram of hydrant and spary system (A) | 42 days | Thu 21-08-14 | Wed 01-10-14 |
| 1130 | MVW Spary layout (A) | 42 days | Mon 20-10-14 | Sun 30-11-14 |
| 1131 | Pressure drop calculation for MVW spary system (I) | 21 days | Mon 20-10-14 | Sun 09-11-14 |
| 1132 | Hydrant Layout (A) | 42 days | Thu 21-08-14 | Wed 01-10-14 |
| 1133 | Pressure drop calculation for hydrant system (I) | 21 days | Thu 21-08-14 | Wed 10-09-14 |
| 1134 | Block diagram of fire detection and alarm system (A) | 42 days | Fri 05-09-14 | Thu 16-10-14 |
| 1135 | Layout of fire detection and alarm systemfor transformer & GIS hall (A) | 42 days | Fri 05-09-14 | Thu 16-10-14 |
| 1136 | Schedule of Fire extinguisher (A) | 42 days | Sat 20-09-14 | Fri 31-10-14 |
| 1137 | Electrical load list (I) | 21 days | Fri 10-10-14 | Thu 30-10-14 |
| 1138 | 220 KV Cables and accessories package | 161 days | Fri 08-08-14 | Thu 15-01-15 |
| 1139 | 220 KV Cable drawing and Technical Data Sheet (A) | 42 days | Wed 13-08-14 | Tue 23-09-14 |
| 1140 | GIS termination drawing & Technical Data Sheet (A) | 42 days | Thu 28-08-14 | Wed 08-10-14 |
| 1141 | Outdoor Termination drawing & Technical Data Sheet (A) | 42 days | Thu 28-08-14 | Wed 08-10-14 |
| 1142 | Bonding cable drawing & Technical Data Sheet (A) | 42 days | Wed 17-09-14 | Tue 28-10-14 |
| 1143 | Earthing Link Box drawing including Lightning arrester & Technical Data Sheet | 42 days | Tue 07-10-14 | Mon 17-11-14 |
| 1144 | Cable Fixing clamp drawing & Technical Data Sheet (A) | 42 days | Tue 07-10-14 | Mon 17-11-14 |
| 1145 | Cable Drums details (A) | 42 days | Thu 28-08-14 | Wed 08-10-14 |
| 1146 | Circuit earthing drawing (A) | 42 days | Thu 28-08-14 | Wed 08-10-14 |
| 1147 | General Cable Support drawing with Four horizontal supports including hardware & | 42 days | Mon 27-10-14 | Sun 07-12-14 |
| 1148 | General Cable Support drawing with Two horizontal supports including hardware & | 42 days | Mon 27-10-14 | Sun 07-12-14 |
| 1149 | Outdoor Termonation Support Structure drawing at the pothead yard including hardware, inserts & foundation at | 42 days | Mon 27-10-14 | Sun 07-12-14 |
| 1150 | GIS Termination Support Structure drawing at GIS hall Indoor Termination including | 42 days | Mon 27-10-14 | Sun 07-12-14 |
| 1151 | Special Cable support structures drawing (A) | 42 days | Mon 27-10-14 | Sun 07-12-14 |
| 1152 | 220KV Cables Layout in GIS Hall (A) | 42 days | Tue 07-10-14 | Mon 17-11-14 |
| 1153 | 220KV Cables Layout in Cable Tunnel (A) | 42 days | Tue 07-10-14 | Mon 17-11-14 |
| 1154 | 220KV Cables layout in Pothead yard (A) | 42 days | Tue 07-10-14 | Mon 17-11-14 |
| 1155 | Layout and cable installation drawing (A) | 42 days | Tue 07-10-14 | Mon 17-11-14 |




LTHEP
Detailed L2 Schedule
Revised on 21.03.13

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | Deadline

37 out of 54

Approved

बी. के. वर्मा / B. K. VERMA
अपर महाप्रबंधक (पी पी एण्ड एम)
Addl. General Manager (PP&M)
एनटीपीसी लिमिटेड / NTPC Limited

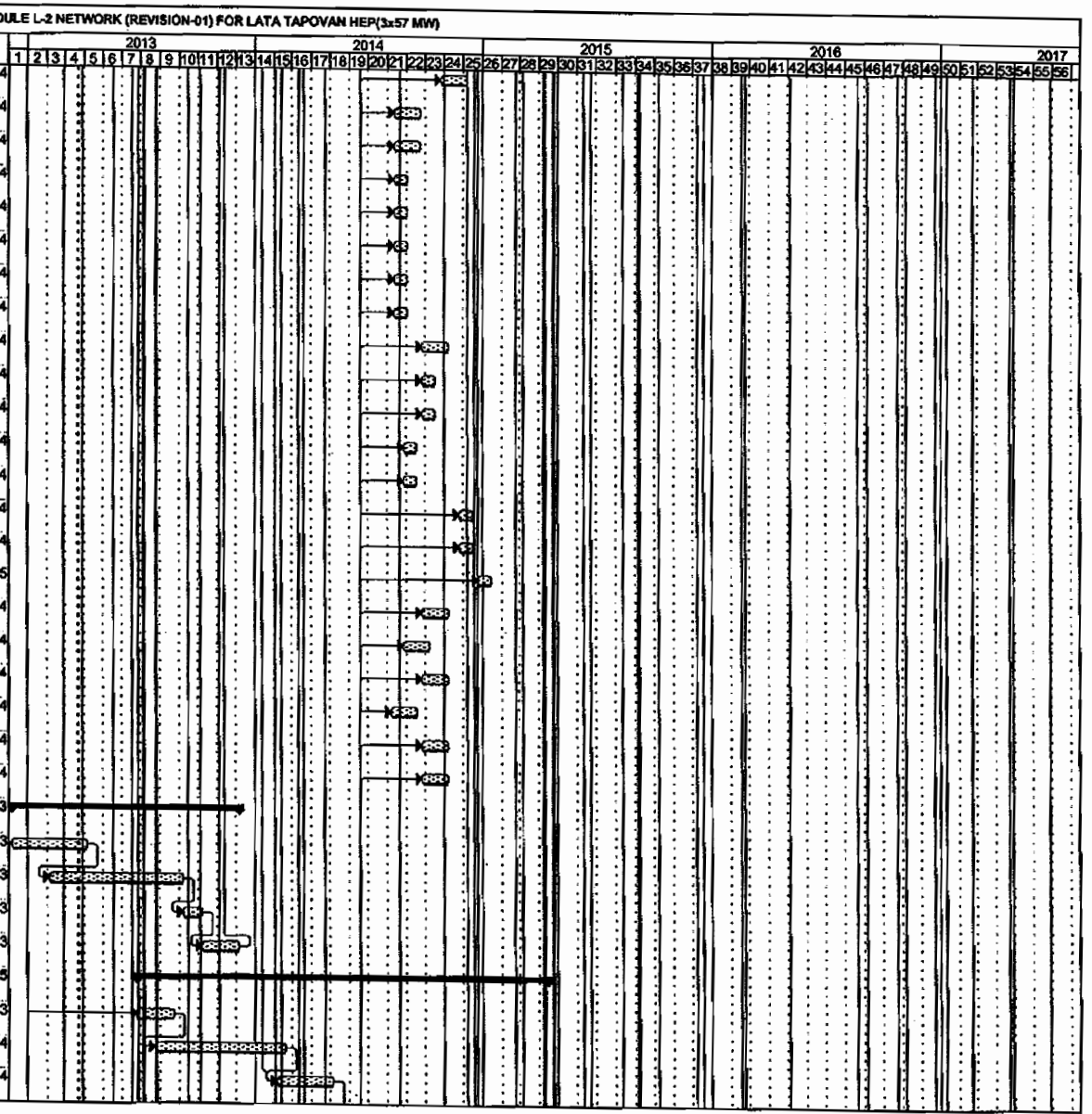
Power Sector, Hydro, Marketing
Siri Fort, New Delhi

Page 1

ANNEXURE-IV

PROJECT SCHEDULE L-2 NETWORK (REVISION-01) FOR LATA TAPOVAN HEP(3x57 MW)

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1156 | Cable and Accessories load on civil work in GIS Hall, Cable Tunnel & Potheadyard (A) | 42 days | Mon 27-10-14 | Sun 07-12-14 |
| 1157 | Calculation of cable continuous rated current (A) | 42 days | Wed 13-08-14 | Tue 23-09-14 |
| 1158 | Calculation of cable short circuit current (A) | 42 days | Wed 13-08-14 | Tue 23-09-14 |
| 1159 | Cable loss calculation (I) | 21 days | Wed 13-08-14 | Tue 02-09-14 |
| 1160 | Electrodynamic force calculation in short circuit (I) | 21 days | Wed 13-08-14 | Tue 02-09-14 |
| 1161 | Cable Mechanical strength calculation (I) | 21 days | Wed 13-08-14 | Tue 02-09-14 |
| 1162 | Overvoltage calculation of cable sheath protection (I) | 21 days | Wed 13-08-14 | Tue 02-09-14 |
| 1163 | Calculation of pulling force and side pressure during cable laying and installation | 21 days | Wed 13-08-14 | Tue 02-09-14 |
| 1164 | Structure Design calculations for Cable Supports (in GIS Hall, Cable tunnel & | 42 days | Sat 27-09-14 | Fri 07-11-14 |
| 1165 | Calculation of cable length (I) | 21 days | Sat 27-09-14 | Fri 17-10-14 |
| 1166 | Cable reels handling and storage (I) | 21 days | Sat 27-09-14 | Fri 17-10-14 |
| 1167 | Storage of Termination & other material (I) | 21 days | Thu 28-08-14 | Wed 17-09-14 |
| 1168 | Cable installation (I) | 21 days | Thu 28-08-14 | Wed 17-09-14 |
| 1169 | GIS termination Assembly & Erection (I) | 21 days | Wed 26-11-14 | Tue 16-12-14 |
| 1170 | Outdoor termination Assembly & Erection (I) | 21 days | Wed 26-11-14 | Tue 16-12-14 |
| 1171 | Operation and Maintenance Procedure (I) | 21 days | Fri 26-12-14 | Thu 15-01-15 |
| 1172 | Manufacturing Quality plan for 220KV Cables, Accessories & Support structures | 42 days | Sat 27-09-14 | Fri 07-11-14 |
| 1173 | Type Test Procedure for 220KV Cable & Accessories (A) | 42 days | Thu 28-08-14 | Wed 08-10-14 |
| 1174 | Type Test Reports for 220KV Cables & Accessories (A) | 42 days | Sat 27-09-14 | Fri 07-11-14 |
| 1175 | Field Quality Plan (A) | 42 days | Fri 08-08-14 | Thu 18-09-14 |
| 1176 | Commissioning Test Procedure (A) | 42 days | Sat 27-09-14 | Fri 07-11-14 |
| 1177 | Structure Design Calculation for Support for Outdoor Cable Termination (A) | 42 days | Sat 27-09-14 | Fri 07-11-14 |
| 1178 | **Model testing (HSS)** | 365 days | Fri 07-12-12 | Fri 06-12-13 |
| 1179 | Submission of process & approval | 120 days | Fri 07-12-12 | Fri 05-04-13 |
| 1180 | Model design & fabrication | 215 days | Tue 05-02-13 | Sat 07-09-13 |
| 1181 | Model testing | 30 days | Sun 08-09-13 | Mon 07-10-13 |
| 1182 | Model test result, submission & acceptance | 60 days | Tue 08-10-13 | Fri 06-12-13 |
| 1183 | **Grounding & Earthing system** | 669 days | Tue 25-06-13 | Wed 15-04-15 |
| 1184 | Soil resistivity testing | 60 days | Tue 25-06-13 | Fri 23-08-13 |
| 1185 | Design & approval | 210 days | Thu 25-07-13 | Wed 19-02-14 |
| 1186 | Procurement & manufacturing | 90 days | Thu 06-02-14 | Tue 06-05-14 |




LTHEP
Detailed L2 Schedule
Revised on 21.03.13

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary | Deadline

38 out of 64

Approved

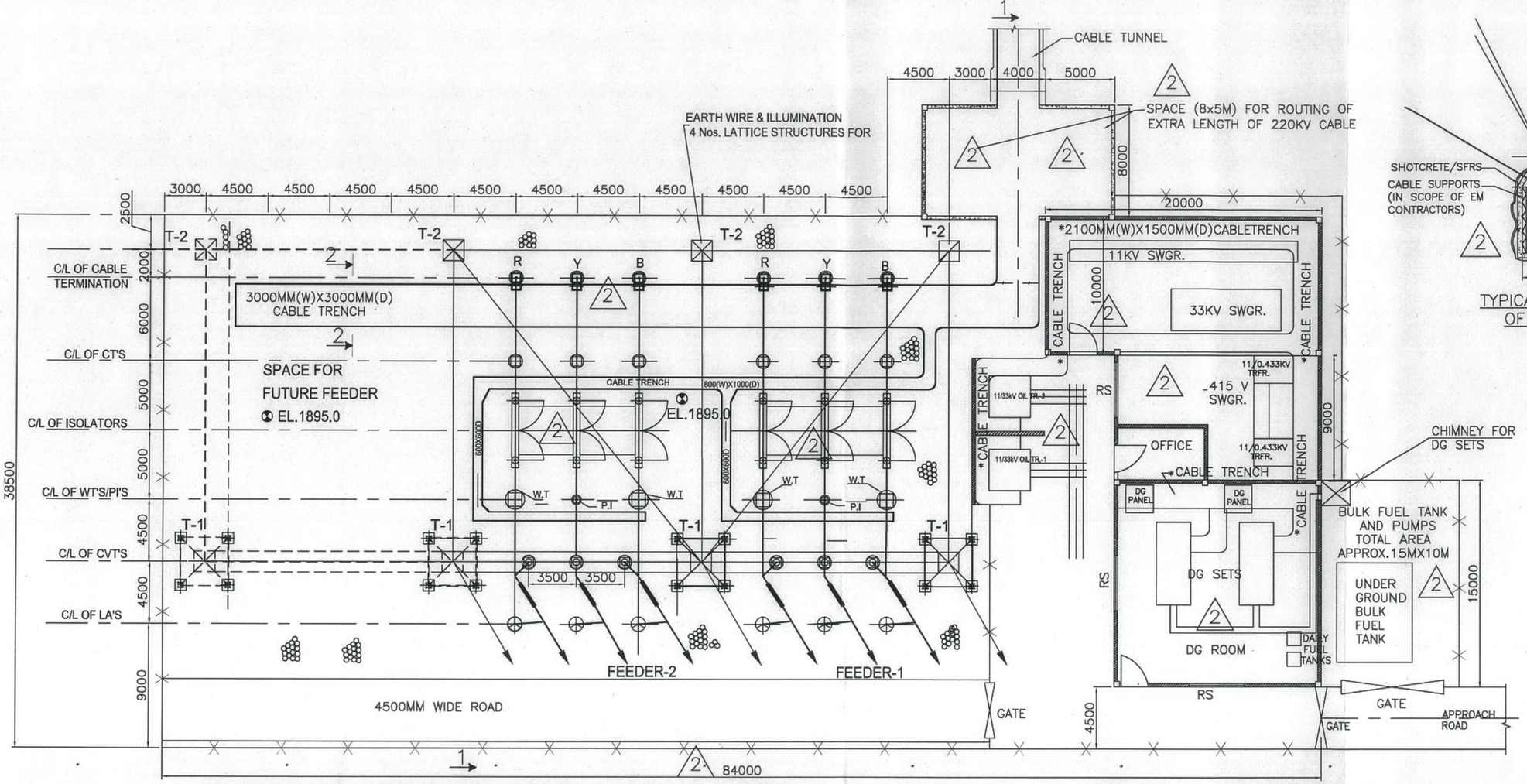
बी. के. वर्मा / B. K. VERMA
अपर महाप्रबंधक (पी पी एण्ड एम)
Addl. General Manager (PP&M)
एनटीपीसी लिमिटेड/NTPC Limited

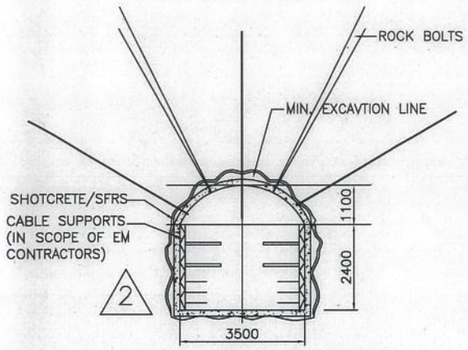
Power Sector, Hydro Market
Sirt Fort, New Delhi

RS-PMG, Vasant Kunj New Delhi

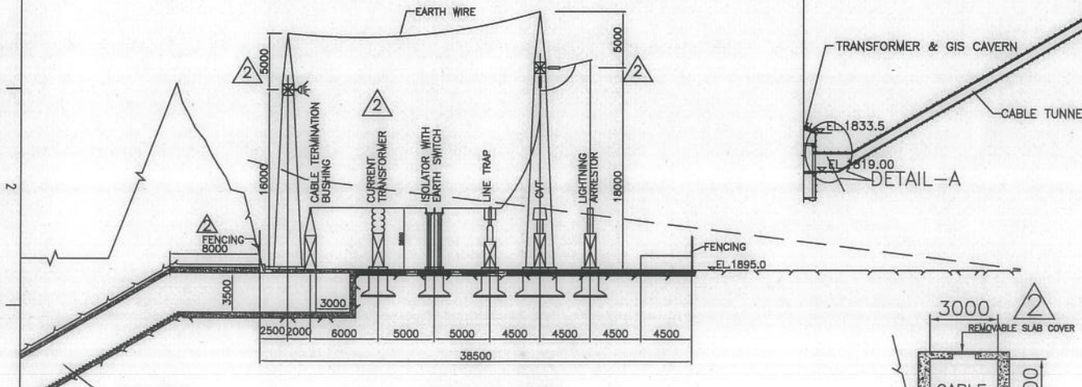
page 2

# PLAN (220KV POTHEAD YARD & EM BUILDING)

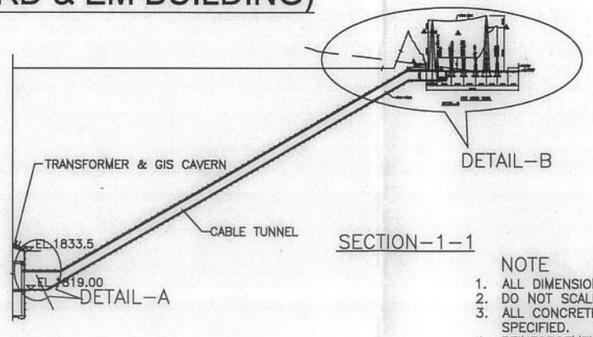


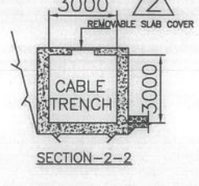

TYPICAL CROSS SECTION
OF CABLE TUNNEL



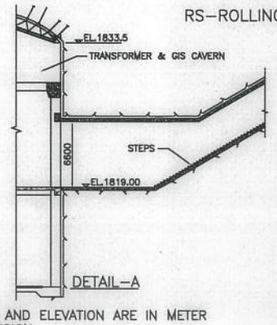

POT HEAD YARD
DETAIL–B




DETAIL–B
DETAIL–A
SECTION–1–1




SECTION–2–2




DETAIL–A

RS–ROLLING SHUTTER

NOTE

1. ALL DIMENSIONS ARE IN MM AND ELEVATION ARE IN METER
2. DO NOT SCALE ANY DIMENSION
3. ALL CONCRETE SHALL BE OF M–25 GRADE CONFORMING TO IS:456 UNLESS OTHERWISE SPECIFIED.
4. REINFORCEMENT SHALL BE USED HYSD BARS CONFORMING TO IS:1786
5. POTHEAD YARD AREA SHALL BE PROVIDED WITH A 150MM THICK LAYER OF STONE(75MM THICK LAYER OF 20MM STONE AGGREGATE AT BOTTOM AND 75 MM THICK LAYER OF 40MM STONE AGGREGATE ON THE TOP)AND MAKE PROPERLY BE COMPACTED AS PER SPECIFICATION.
6. FOR CABLE TUNNEL LAYOUT PLAN REFER DWRAWING No.–2006107/WR/TD–113
7. FOR ANCHOR SUPPORT CONSOLIDATION GROUTING, CONTACT GROUTING. & SHOTCRETE SHALL BE PROVIDED AS PER DETAILED DESIGN. SUITABLE ARRANGEMENT FOR PREVENTING ENTRY OF RAIN WATER FROM POT HEAD YARD END INTO THE CABLE TUNNEL INCLUDING POTHEAD YARD DRAINAGE SYSTEM SHALL BE MADE.
8. ALL CIVIL WORKS SHALL BE WITHIN THE SCOPE OF CIVIL CONTRACTOR(EPC–1).
9. FENCING AROUND THE POTHEAD YARD TO BE PROVIDED AS INDICATED
10. * THE DETAILS & SIZES OF CABLE TRENCHES/CABLE TUNNEL ARE INDICATIVE ONLY AND SHALL BE FINALISED DURING DETAILED ENGG. AS PER SYSTEM REQUIREMENT.
11. ISOLATORS ARE HORIZONTAL CENTER BREAK(HCB) TYPE.

0 1 2.5 5m.

FOR TENDER PURPOSE ONLY

एनटीपीसी NTPC
एनटीपीसी हाइड्रो लि०
(एनटीपीसी की पूर्ण स्वामित्व वाली सहायक कम्पनी)
NTPC HYDRO LIMITED
(A wholly owned subsidiary of NTPC)

PROJECT: LATA TAPOVAN HYDRO ELECTRIC PROJECT
(3 x 57 MW)

TITLE: POT HEAD YARD & CABLE TUNNEL DETAILS

| Drawn by | Designed By | Checked By | Approved by |
|---|---|---|---|
| S.C.NARAYAN | D.JAIN | P.K.SANDHI | V.K.JAIPUR |

NHL Drawing Number : 5601-002-P-E-C-A-531 | 2
FORMAT : FORMAT–A1 | SCALE : X
CES Drawing Number : 2006107/WR/TD-131 | REV 0 | SEP–08

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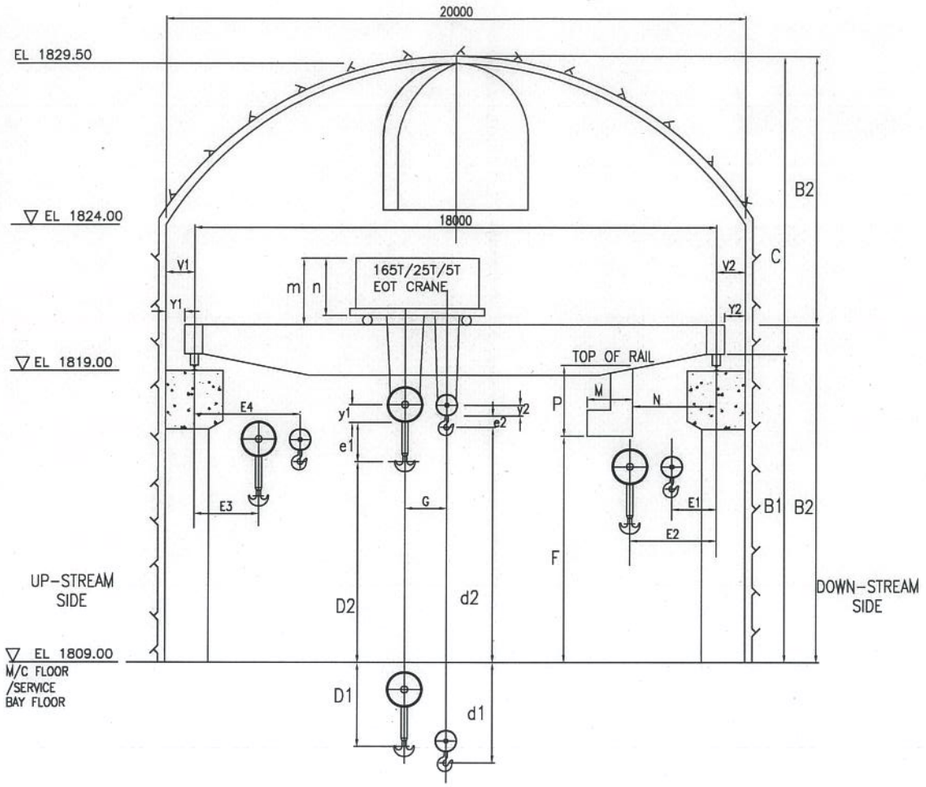
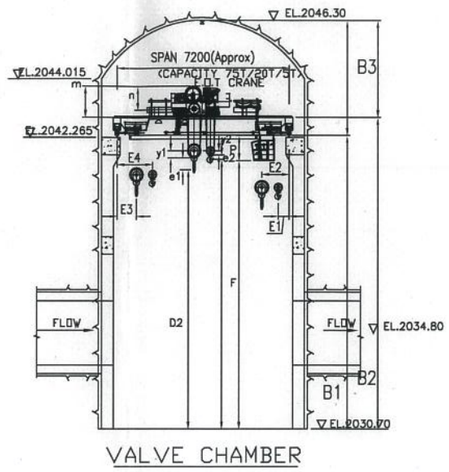
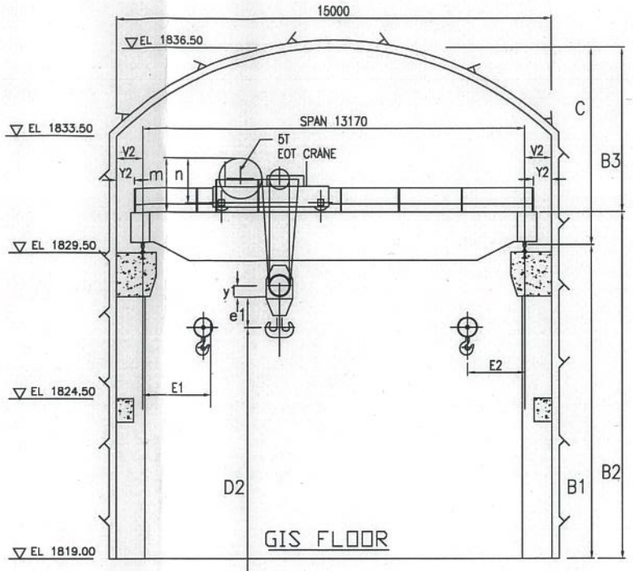
NEW DELHI KOLKATA MUMBAI




P.H. CAVERN




VALVE CHAMBER




UPTO TRANSFORMER FLOOR (EL.1809.00M.)

TABLE- A (75T/20T/5T EOT CRANE)

| DIMENSION IN MM. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 7600 | | | f | | K2 | | Q | | U2 | |
| a | | E1 | 1000* | G | | L1 | | R1 | | V1 | 400 |
| B1 | | E2 | 2000* | h | | L2 | | R2 | | V2 | 400 |
| B2 | | E3 | 1800* | g1 | | M | | S | | Y1 | |
| B3 | | E4 | 2800* | g2 | | N | | T1 | | Y2 | |
| b | | e1 | | J1 | | m | | T2 | | y1 | |
| C | | e2 | | J2 | | n | | t | | y2 | |
| D2 | >11000 | F | | K1 | | P | | U1 | | | |

(*) VALUES INDICATED ARE TTENTATIVE

TABLE - A 1 NOS.(165/25T/5T EOT CRANE)

| DIMENSION IN MM. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 17500 | d1 | ≃ 20500 | f | | K3 | | Q | | V1 | 950 |
| a | | d2 | >9000 | G | | K4 | | R1 | | V2 | 950 |
| B1 | | E1 | 1500* | g1 | | L1 | | R2 | | Y1 | |
| B2 | | E2 | 2900* | g2 | | L2 | | S | | Y2 | |
| B3 | | E3 | 2100* | h | | M | | T1 | | y1 | |
| b | | E4 | 3500* | J1 | | N | | T2 | | y2 | |
| C | | e1 | | J2 | | m | | t | | | |
| D1 | ≃ 17000 | e2 | | K1 | | n | | U1 | | | |
| D2 | ≥ 8500 | F | | K2 | | P | | U2 | | | |

(*) VALUES INDICATED ARE TTENTATIVE

TABLE - A (5T EOT CRANE)

| DIMENSION IN MM. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A | 13800 | D2 | >19000 | h | | m | | U2 | |
| a | | E1 | 750* | J1 | | n | | V1 | 750 |
| B1 | | E2 | 750* | J2 | | S | | V2 | 750 |
| B2 | | e1 | | K1 | | T1 | | X1 | |
| B3 | | f | | K2 | | T2 | | y1 | |
| b | | g1 | | L1 | | t | | Y1 | |
| C | | g2 | | L2 | | U1 | | Y2 | |

(*) VALUES INDICATED ARE TTENTATIVE

FOR TENDER PURPOSE ONLY

| REV. | DATE | DESCRIPTION | CHECKED | APPROVED |
|---|---|---|---|---|
| | | REVISION | | |

एनटीपीसी NTPC हाइड्रो Hydro

एनटीपीसी हाइड्रो लि०
(एनटीपीसी की पूर्ण स्वामित्व वाली सहायक कम्पनी)
**NTPC HYDRO LIMITED**
(A wholly owned subsidiary of NTPC)

PROJECT **LATA TAPOVAN HYDRO ELECTRIC PROJECT**
*(3 x 57 MW)*

TITLE

GUARANTEED CRANE
CLEARANCES AND LIMITS

| Drawn by | Signature /Date | Designed By | Signature /Date | Checked By | Signature /Date | Approved by | Signature /Date |
|---|---|---|---|---|---|---|---|
| H.B.JOSHI | | S. BABU | | N.K.ARORA | | V.K.KAPUR | |

NHL Drawing Number : 5601-003-P-E-M-A-710 | 2

FORMAT : FORMAT-A1 | SCALE : X

CES Drawing Number : 2006107/WR/TD-310 | REV 2 | JAN-11

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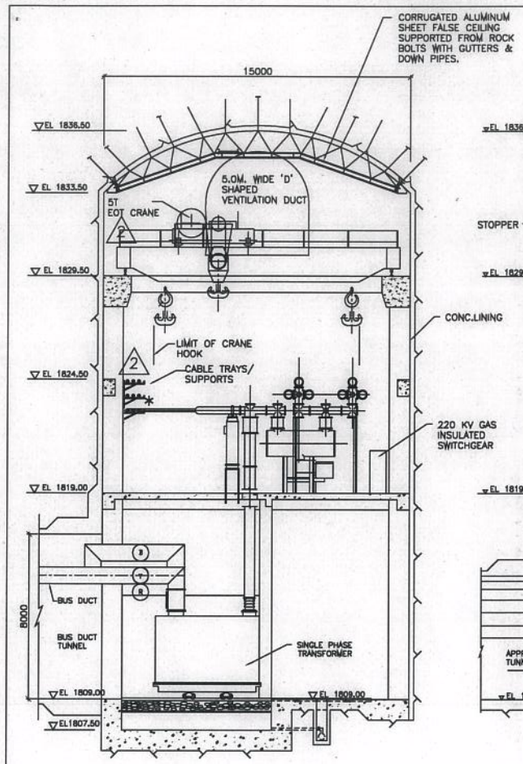
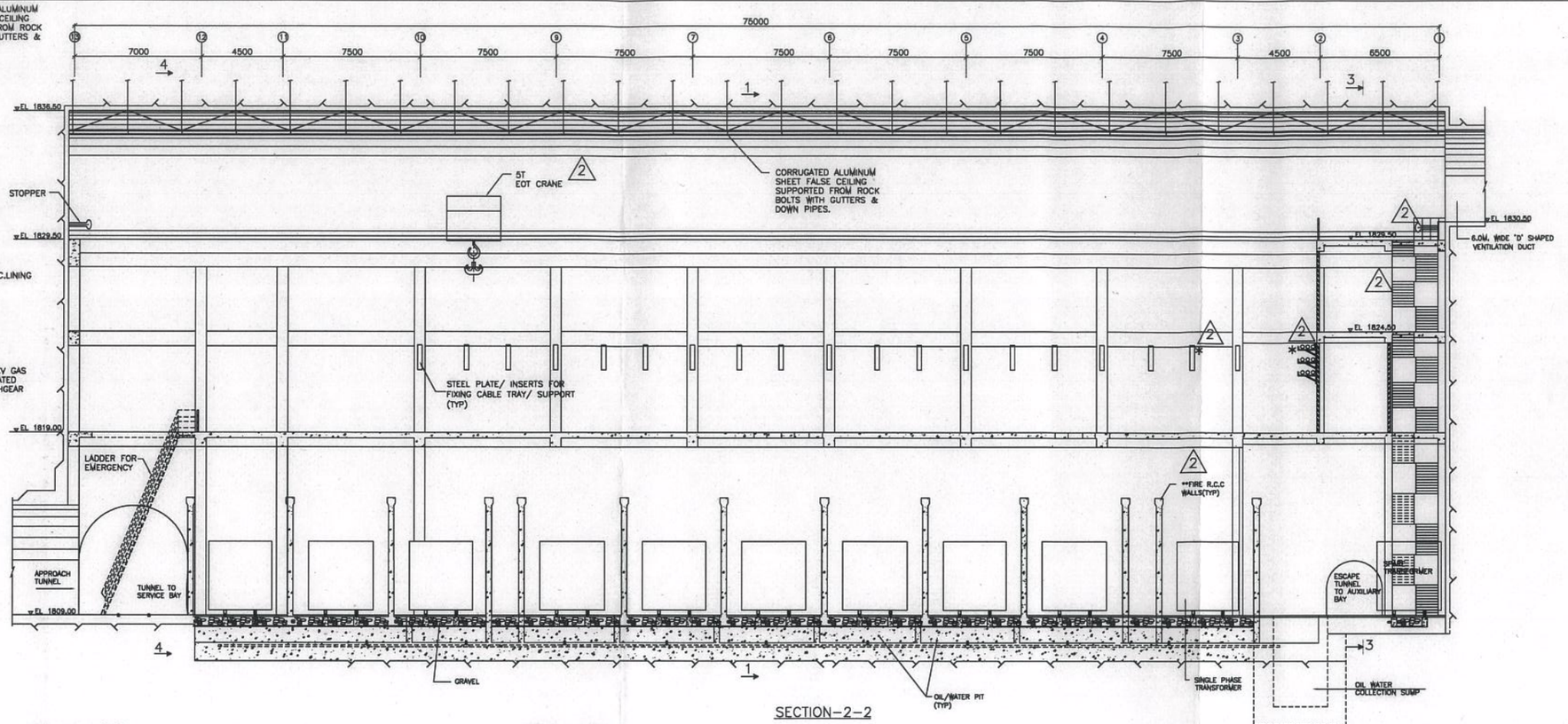
NEW DELHI KOLKATA MUMBAI




SECTION–1–1

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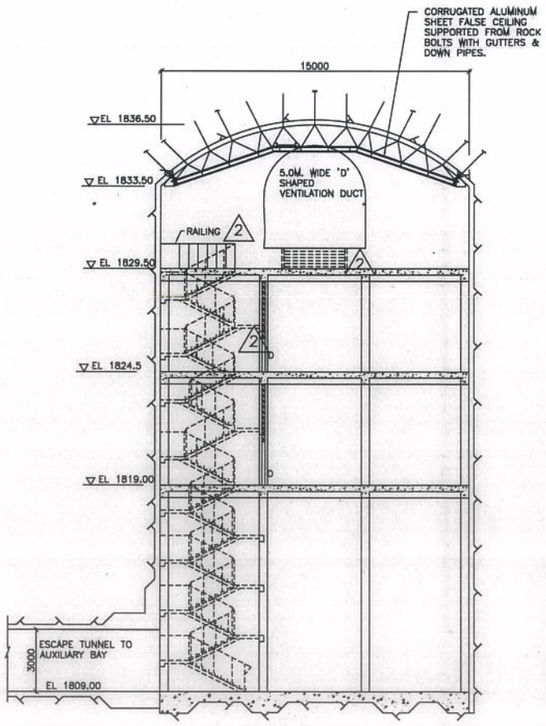


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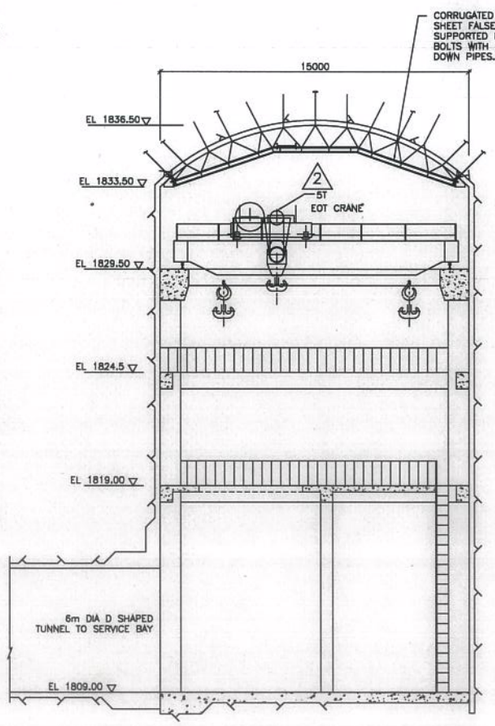



SECTION–4–4

2 * THE INSERTS AS SHOWN FOR EM SYSTEMS ARE INDICATIVE ONLY. LOCATIONS OF INSERTS FOR CABLE SUPPORTS/TRAYS SHALL BE DECIDED DURING DETAILED ENGINEERING AS PER REQUIREMENT OF EM SYSTEM.

2 ** HEIGHT OF FIRE WALLS AS SHOWN ARE INDICATIVE ONLY AND SHALL BE PROVIDED AS PER SYSTEM REQUIREMENT/ IS 1646.

NOTES:
1. FOR NOTES REFER DRG. No.–2006107/WR/TD–128

SCALE
0 1 2.5 5m.

FOR TENDER PURPOSE ONLY

| REV. | DATE | DESCRIPTION | CHECKED | APPROVED |
|---|---|---|---|---|
| A | JAN. 2011 | AS MARKED | | |

REVISION

एनटीपीसी NTPC हाइड्रो Hydro
एनटीपीसी हाइड्रो लि०
(एनटीपीसी की पूर्ण स्वामित्व वाली सहायक कम्पनी)
**NTPC HYDRO LIMITED**
(A wholly owned subsidiary of NTPC)

PROJECT **LATA TAPOVAN HYDRO ELECTRIC PROJECT**
*(3 x 57 MW)*

TITLE

TRANSFORMER & GIS CAVERN
SECTIONS- 1-1 TO 4-4

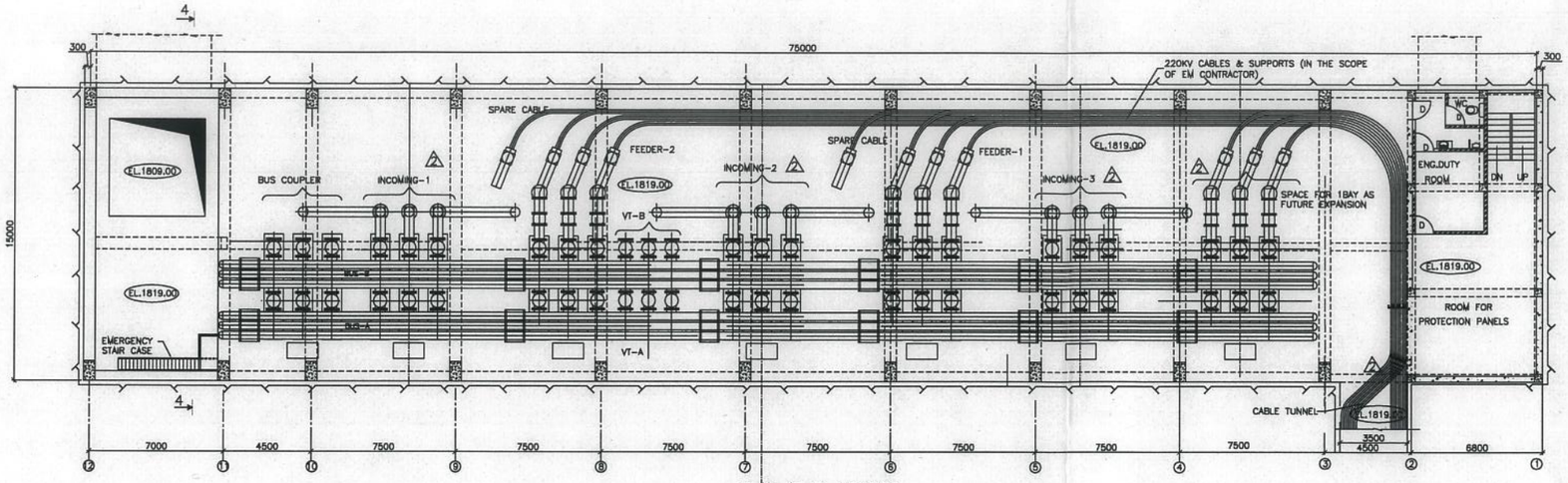
| Drawn by | Signature /Date | Designed By | Signature /Date | Checked By | Signature /Date | Approved by | Signature /Date |
|---|---|---|---|---|---|---|---|
| S.C.MAMGAIN | | D.JAIN | | P.K.SANGHI | | V.K.KAPUR | |

NHL Drawing Number : 5601-002-P-E-C-A-529 | 2

FORMAT :FORMAT–A1 | SCALE : X

CES Drawing Number : 2006107/WR/TD-129 | REV 1 | MAY'09

CONSULTING ENGINEERING SERVICES (I) PVT LTD.
NEW DELHI KOLKATA MUMBAI

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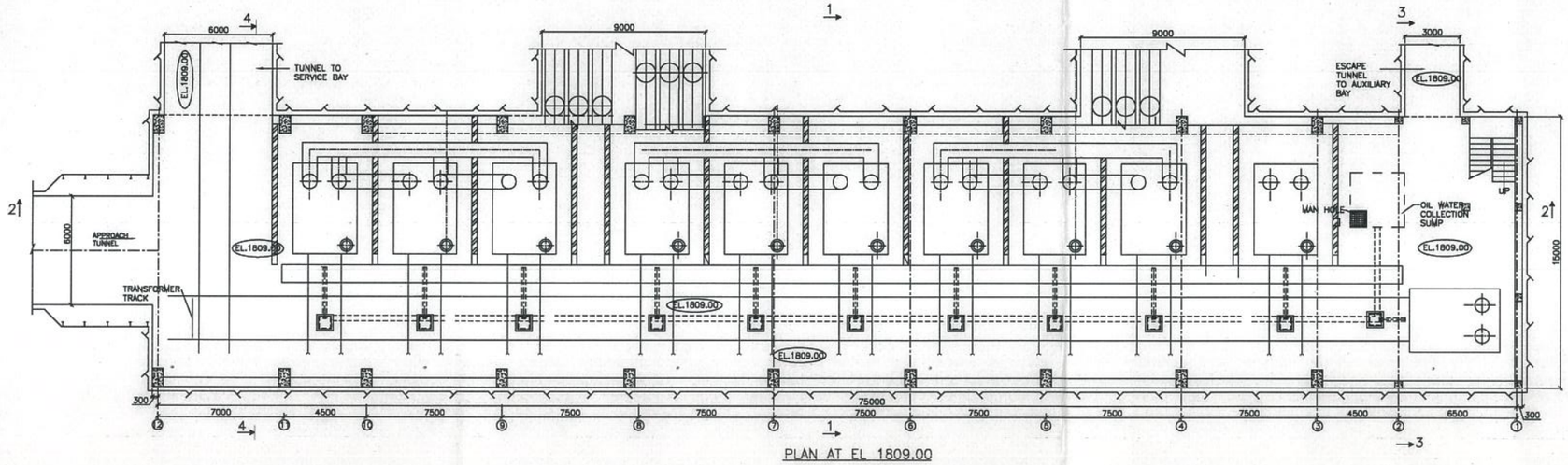
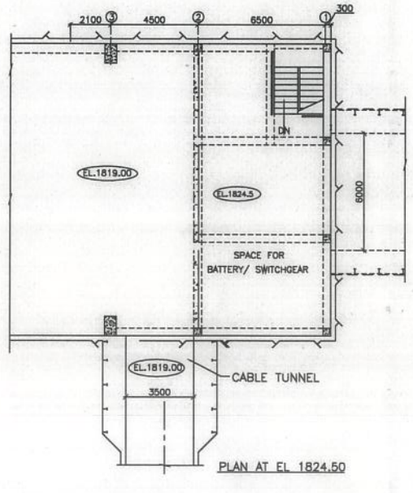
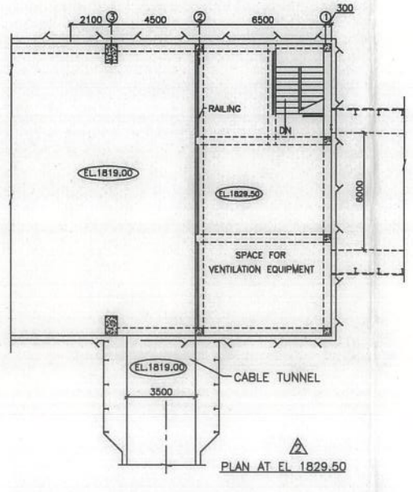



PLAN AT EL 1809.00




PLAN AT EL 1824.50




PLAN AT EL 1829.50

NOTES:–

1. ALL DIMENSIONS ARE IN mm AND ELEVATIONS IN METERS.
2. DO NOT SCALE DIMENSIONS ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
3. REINFORCEMENT SHALL BE USED HYSD BARS Fe–415, CONFORMING TO IS:1786–1985.
4. CONCRETE LINING M–25 GRADE
5. BEAM, COLUMN AND SLAB M–25 GRADE

SCALE 0 1 2.5 5m.

FOR TENDER PURPOSE ONLY

| REV. | DATE | DESCRIPTION | CHECKED | APPROVED |
|---|---|---|---|---|
| A | JAN. 2011 | AS MARKED | | |

REVISION

एनटीपीसी NTPC हाइड्रो Hydro

एनटीपीसी हाइड्रो लि०
(एनटीपीसी की पूर्ण स्वामित्व वाली सहायक कम्पनी)
**NTPC HYDRO LIMITED**
(A wholly owned subsidiary of NTPC)

PROJECT **LATA TAPOVAN HYDRO ELECTRIC PROJECT**
*(3 x 57 MW)*

TITLE

TRANSFORMER & GIS CAVERN
GENRAL ARRANGEMENT PLANS

| Drawn by | Signature /Date | Designed By | Signature /Date | Checked By | Signature /Date | Approved by | Signature /Date |
|---|---|---|---|---|---|---|---|
| S.C.MAMGAIN | | D.JAIN | | P.K.SANGHI | | V.K.KAPUR | |

| | | | |
|---|---|---|---|
| NHL Drawing Number : | 5601-002-P-E-C-A-528 | | 2 |
| FORMAT : FORMAT–A1 | SCALE : X | | |
| CES Drawing Number : | 2006107/WR/TD-128 | REV 1 | MAY'09 |

CONSULTING ENGINEERING SERVICES (I) PVT LTD.
NEW DELHI KOLKATA MUMBAI

# SECTION – 2

NTPC Technical Specification for 220 kV Cables & Accessories (E16)- (15 pages) enclosed

Amendments to above specification are as below:

| Clause no. | Existing Provision | Amended Provision |
|---|---|---|
| Page No 2 of 15, Clause 1.01.00 | | The following standards are **added**:<br>IS 277: Galvanised sheet steel<br>IS 316: Code of practice for use of metal arc welding for general construction in mild steel.<br>IS 800: Specification for use of structural steel in general building construction<br>IS 802: Code of practice for the use of structural Steel in Overhead Transmission Line Towers.<br>IS 2062: Structural Steel (Standard quality)<br>IS 2629: Recommended practice for hot dip galvanising of iron & Steel.<br>IS 2623: Method for testing uniformity of coating on zinc coated article.<br>IS 6745: Methods for determination of mass of zinc coated iron & steel articles. |
| Page No. 5 of 15, Clause 3.01.01, line-7,8 | Extruded flame retardant Polyethylene (PE)/ FRLS PVC outer sheath with overall graphite coating. | Extruded flame retardant Polyethylene (PE)/ FRLS PVC outer sheath with overall **semi conductive/** graphite coating. |
| Page No. 8 of 15, Clause 5.02.01, Line-5-6 | .....a water tight box of min 2mm thick CRCA steel having degree of protection as IP 55. | .....a water tight box of min 2mm thick CRCA, **hot dip galvanised** steel having degree of protection as IP 55. |
| Page No. 8 & 9 of 15, Clause 5.02.05, line 6 | Be 1.1 kV grade, single core, XLPE insulated and PVC outer sheathed. | Be 1.1 kV grade, single core, XLPE insulated and **FRLS** PVC outer sheathed. |

| | | |
|---|---|---|
| Page No. 9 of 15, Clause 5.02.06, line 3-4 | .....smooth and free from spangle as possible. All galvanising..... | .....smooth and free from **flaws such as laminations, rolling marks, pitting etc. The bidder shall submit design calculations of supporting structure for approval.** . All galvanising..... |
| Page No. 13 of 15, Clause 7.01.02, line 3 | ...relevant standard. | ...relevant standard. The bonding cable of 1.1 kV grade shall meet the Type test requirements as indicated under Clause 6.01.02 of HT Cables, LT Power Cable as and Control Cables (E11) |
| Page No. 13 of 15, Clause 7.03.00 | .....<br>b) Vertical support Channel nut slip characteristics<br>c) Weld Integrity test..... | .....<br>b) Support Channel nut slip characteristics<br>c) Weld Integrity test (**magnetic particle inspection**)..... |
| Page No. 13 of 15, Clause 7.03.00 | | **Add** new Clause **7.03.01**<br>The following tests shall be carried out as acceptance tests:<br>a) All tests as mentioned at Sl. No. 7.03.00 as per agreed Type Test Procedure.<br>b) Galvanising tests as per applicable standard.<br>c) Die Penetration tests to check weld integrity after load test.<br>The above acceptance tests shall be carried out on one sample from each offered lot. |
| Page No. 14 of 15, Clause 7.00.00 | ..... | **Add** New Clause **7.05.00**<br>COMMISSIONING CHECKS<br>I) 220 kV Cables & Terminations, accessories, Link boxes etc.:<br>a) Check for physical damage<br>b) Check of correctness of all connections as per relevant drawings<br>Check for proper earth connections for Cable supports & terminations, Link boxes, Cable screens etc.<br>d) Check for provision of correct cable tags, tightness of connections, cable clamps etc.<br>II) Supports/ structure for 220 kV cables & Terminations, Accessories, link boxes etc.<br>a) Check for proper galvanising/ painting and identifications<br>b) Check that all sharp corners, burrs and waste material have been removed. |

## CONTENTS

**1.00.00** **CODES AND STANDARDS**

1.01.00 The design, manufacture, testing and performance of the cables supplied under this specification shall comply with the latest edition of the following Standards, Rules and Acts.

**IEC Standards**

| | |
|---|---|
| IEC 62067 | Power cables with extruded insulation and their accessories for rated voltages above 150kv (Um=170kv) up to 500 kV (Um=550kv) Test methods and requirements |
| IEC 60540 | Test methods for insulation and sheath of electric cables and cords (Elastomeric and thermoplastic compounds) |
| IEC 60885 | Electrical test methods for Electric cables. |
| IEC 60228 | Conductors of Insulated cables |
| IEC 60229 | Tests on cable over-sheath which have a special protective function and are applied by extrusion. |
| IEC 61462 | Composite Insulators- Hollow insulators for use in outdoor and indoor electrical equipment - Definitions, test methods, acceptance criteria and design recommendations |
| IEC 60183 | Guide to the selection of high voltage cables |
| IEC 60270 | Impulse tests on cables and their accessories. |
| IEC 60230 | High Voltage Test Techniques<br>- Partial discharge measurements |
| IEC 60287 | Electric cables - Calculations of the current ratings |
| IEC 60811 Part-1 to 4 | Common test methods for insulating and sheathing materials of electric cables |
| IEC 60885 Part-3 | Electrical test methods for electric cables<br>-Test methods for partial discharge measurements on lengths of extruded power cables. |
| IEC 60060 Part 1 | High Voltage Test Techniques |
| IEC 60187 | General Definitions & Test Requirements |
| IEC 60068 | Seismic Test Methods For Equipments |
| IEC 60137 | Insulated Bushings for alternating Voltages for above 1000 volts |
| IEC 60506 | Switching Impulse test on EHV insulators |
| IEC 60376 | Specifications & acceptance of new SF6 Gas |

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|---|---|
| | IEC 60332 Part 1 — Test on electric cables under fire conditions |
| | IEC 60859 — Cable connections for gas insulated metal enclosed switchgear |
| | ANSI/IEEE/IS Std and Rules — Guide Electrical safety and Sub- station grounding: 80- 2000 |
| | **Indian Standards & Rules** |
| | IS 5216 — Guide for safety procedures and practice in electrical works. |
| | IS 7098 (Part-II) — XLPE Cable for working voltage 66kV up to and including 220kV |
| | Indian Electricity Act 1910. |
| | IS 5831 — Electric Power Connectors |
| | IS 2633 — Methods for testing uniformity of coating in Zinc coated articles |
| | IS 1893 — Criteria for earth quake resistant design of structures |
| 1.02.00 | * refer amendment<br>220 kV cables accessories and support systems meeting any other international standard which ensures and equal or better quality than the standard mention above are also acceptable. The contractor proposing any other standards than the above referred standards must specifically indicate the standards to which the cable conforms. The deviations, if any, from the above codes & standards that affect performance and rating are required to be clearly indicated by the bidder with the offer. The bidder is required to furnish copies of the applicable standards in English language at the time of bidding. |
| 1.03.00 | The compliance of 220 kV cables & accessories manufactured with the provisions of these specifications shall not relieve the contractor of his responsibility of furnishing cables of proper design, electrically & mechanically suitably to meet the operating guarantees at the specified service conditions. |
| **2.00.00** | **GENERAL DESIGN ASPECTS** |
| 2.01.00 | **Mechanical Aspects** |
| 2.01.01 | The 220 KV cables for both the outgoing circuits shall be installed in the same tunnel/ trench, which is naturally ventilated and no forced ventilation cooling is envisaged. |
| 2.01.02 | Each 220 KV cable of single core 400 sq.mm size shall be supplied in single length. The exact length of each cable shall be finalized during detailed design stage. The cable joints shall not be permitted. |

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| 2.01.03 | Laying arrangement of 220 KV cables shall be such as to achieve optimum space saving, neat and logical arrangement when laid in horizontal snaking formation. The routine inspections and possible repairs for all elements shall be accessible without removing support structures. |
| 2.01.04 | The 220 KV cables shall be securely supported for the entire length with suitable cable clamps and spacers to maintain continuous equal space between the cables laid in horizontal snaking formation. |
| 2.01.05 | Cables shall be supported on suitable cable supporting arrangement of galvanized steel in such a way so as to avoid development of any type of stress in the cable. The laying of cables shall be in a horizontal snaking formation to absorb the thermal expansion and contraction of the cables. Necessary calculations in this regard shall be furnished during design stage. |
| 2.01.06 | The ambient temperature at project site varies between sub zero to (+) 27°C. The relative humidity varies between 35% to about 70%. However, ambient temperature of (+) 40 °C along with the other climatic parameters as specified, shall be taken in to consideration while designing the cables and accessories. |
| 2.01.07 | All the accessories shall be identical allowing for interchangeability. |
| 2.01.08 | The cable system shall withstand the electro mechanical forces due to short circuit and earth fault currents including superimposed seismic forces. |
| 2.01.09 | All accessories of power cables shall be capable of withstanding the specified seismic forces along with short circuit forces. |
| **3.02.00** | **Electrical Aspects** |
| 3.02.01 | The 220 KV cables and accessories shall be suitable for bi-directional flow of power, under isolated/parallel operation with other circuits of the system and connected to grid system and according to loading cycle of Lata Tapovan H.E. Power Project (3X57 MW). |
| 3.02.02 | All lengths of 220 KV cables and accessories shall be capable of continuous operation at the maximum rated current without exceeding the maximum conductor temperature as specified in the Guaranteed and other Technical Particulars. |
| 3.02.03 | Thermal rating for all current carrying parts of the cable system shall be suitable for the normal rated current and for the rated symmetrical short circuit current of 40kA for duration of 1 second. |
| 3.02.04 | The contours of energized metal parts of the 220KV cable end terminations shall be such as to eliminate areas/points of high electrostatic flux concentrations. Surfaces shall be smooth with no projections or irregularities, which may cause visible corona. |
| 3.02.05 | Metal clamps and spacers for the 220 KV cables and other metal parts shall be of non-magnetic material. |

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| **3.00.00** | **220 KV CABLE** |
| **3.01.00** | **General** |
| 3.01.01 | The cable shall confirm to IEC-62067. The cable shall consists of single core 400 sq. mm stranded copper compacted circular conductor, extruded semi conducting compound conductor screen, cross linked polyethylene (XLPE) dry cured insulation, extruded semi conducting compound insulation screen, bedding of swellable type water blocking semi conducting tape, copper wire screen with copper binder tape(as per requirement), semi conducting swellable tape, aluminium or lead sheath and extruded flame retardant Polyethylene (PE)/ FRLS PVC outer-sheath with overall graphite coating. semi conductive |
| 3.01.02 | The conductor screen, insulation and semi-conducting insulation screen shall be extruded in one operation of triple extrusion process, so as to obtain continuously smooth interfaces. The conductor screen and insulation screen shall be of semi-conducting compound. The copper wire/tape screen together with aluminium or lead sheath shall be capable of withstanding the short circuit current of 40KA for one second. The Bidder shall furnish the supporting calculations for screen sizing. |
| 3.01.03 | The cable shall be suitable for use in solidly earthed system at one point. |
| 3.01.04 | The cable shall be suitable for installation in air in underground tunnels and/or built up concrete trenches with restricted air circulation. The cable shall withstand all mechanical and thermal stresses under steady state and transient operating conditions. There may be chances of water flooding in concrete trenches for which cables shall be suitable. |
| 3.01.05 | Repair to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are also not acceptable. |
| 3.01.06 | Cable ends shall be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture. |
| 3.01.07 | Each cable length shall be provided with a pulling socket eye which shall be fitted to the pulling end. Pulling socket eye shall be able to take the pulling force. |
| 3.01.08 | The Eccentricity of the core shall not exceed 10% and Ovality of the core shall not exceed 5%.<br><br>The Eccentricity shall be calculated as $(t_{max} - t_{min})/t_{max} \leq 0.10$<br><br>The Ovality shall be calculated as $(d_{max} - d_{min})/d_{max} \leq 0.05$<br><br>where $t_{max}/t_{min}$ are the maximum/minimum thickness of insulation and $d_{max}/d_{min}$ are the maximum/minimum diameter of the core. |
| **3.02.00** | **Conductor**<br>Conductor shall consist of plain annealed copper wires in accordance with IEC-60228 or equivalent and the shape shall be circular and very well compacted to |

facilitate a smooth interface between conductor screen(shield) and the insulation. The conductor shall have smooth surface with no intermediate joint.

**3.03.00 Conductor Screen**

Conductor screen shall consist of extruded semi-conducting compound applied over the conductor, which shall be firmly bonded to the inner surface of the insulation layer. The semi-conducting compound shall be free from any void and protrusion.

**3.04.00 Insulation**

Insulation shall be of extruded Cross Linked Polyethylene (XLPE). The insulation shall be free from any void and contaminant. The average thickness of insulation shall not be less than the nominal value guaranteed in the technical particulars. The minimum thickness of insulation at any point shall not be less than 90% of the nominal value guaranteed in technical particulars.

**3.05.00 Insulation Screen**

Insulation screen shall consist of extruded semi-conducting compound and shall firmly be bonded to the insulation. The semi-conducting compound shall be free from any void and protrusion.

**3.06.00 Bedding**

Bedding shall consist of layer(s) of swellable semi conducting tape(s) to be applied over the extruded semi-conducting insulation screen with suitable overlap. Semi-conducting swelling tape(s) shall also be provided over copper wire screen (if applicable).

**3.07.00 Metallic Sheath**

The metallic inner-sheath shall consist of aluminium or lead. The calculations for sizing and short circuit withstand capability of the metallic sheath, along with copper wire screen & copper binder tape (if applicable) shall be submitted during detailed design stage. The average thickness of sheath shall not be less than the nominal value specified in guaranteed technical particulars.

**3.08.00 Outer Sheath**

Outer sheath shall consist of extruded black and flame retardant PE / FRLS PVC compound, in accordance with IEC-62067/60332 Part1.The average thickness shall not be less than the nominal value specified in the guaranteed technical particulars.

**3.09.00 Cable Identification/ Marking**

Atleast the following clear markings shall be provided over outer sheath of the cable at an interval of five metres throughout the length of the cable by embossing:

i) Rated voltage
ii) Conductor size
iii) Type of insulation
iv) Manufacturer's name
v) Year of manufacture
vi) Purchaser's name
vii) Sequential marking of length of cable in metres by embossing/printing at every meter

The embossing/printing shall be progressive, automatic, in line and marking shall be legible and indelible.

**4.00.00 CABLE DRUMS**

4.01.01 Cables shall be supplied in steel drums of heavy construction.

4.01.02 The employer may insist on supply of drums with definite cable lengths (with ±2 meter tolerance)with definite cable lengths to be decided during detailed Engineering. Drums with shorter lengths shall not be accepted. Contractor shall not be reimbursed for any excess lengths supplied. Cable joints shall not be permitted.

**5.00.00 CABLE ACCESSORIES**

**5.01.00 Cable Terminations / Sealing Ends**

Outdoor terminations/sealing ends shall be located in the pothead yard to connect XLPE cables with outdoor type CT for overhead transmission lines emanating from the pothead yard. The SF6 indoor terminations/sealing ends shall be suitable for connection of 1 nos. 1C X 400 sq.mm XLPE cable per phase to one SF6 sealing end located inside the underground GIS Hall to connect XLPE cables with 220 KV Gas Insulated Switchgears (GIS).

Each termination/sealing end shall be complete with all fittings, supporting structures, earthing, accessories, consumables etc. as required during erection, testing and commissioning.

**a) Outdoor Sealing End**

The termination shall be oil filled / SF6 insulation type suitable for connection of 1 Nos. 1C X 400 sq.mm XLPE cable per phase for outdoor installation and shall be made completely weatherproof through cable sealing ends. Accessories shall consist of stress relief system comprising of pre moulded material.

The housing of each of the outdoor sealing end shall be composite type or porcelain type insulator to give high creepage distance. The minimum nominal specific creepage distance shall be 25mm/kV. Each outdoor type sealing end shall be supplied complete with mounting plate insulators to insulate the sealing end from supporting structure.

Each sealing end shall be provided with two terminals, diagrammatically opposite each, suitable for bolting of the metallic sheath of cable.

**b) SF6 Indoor Termination / Sealing End**

The housing of the SF6 indoor termination/ sealing end shall be of epoxy/ porcelain insulator type suitable for use with SF6 gas and shall have sufficient strength against mechanical, electrical and thermal stresses.

All the required fittings, supporting structures, accessories and consumables shall be supplied in order to connect the termination assembly of 220 KV Cables to Gas Insulated Switchgear in isolated single-phase arrangement. The cable termination shall be of SF6 indoor type.

The design and manufacturing of the termination assembly shall be done in accordance with IEC-60859 or equivalent standards. The termination shall be so made that no force is transferred to GIS.

Each sealing end shall be provided with two terminals, diagrammatically opposite each, suitable for bolting of the metallic sheath of cable.

**5.01.00 Link Boxes**

5.02.01 Link boxes shall be suitable for outdoor installation in heavily polluted atmosphere and shall be made completely weather proof. There shall be one link box for each phase. The cable screen/sheath connections shall be bolted type. The connecting bar and disconnecting link shall be of copper. The arrangement shall be installed in a water tight box of min. 2mm thick CRCA* steel having degree of protection as IP 55. Disconnecting links shall be provided to sealing ends to facilitate periodic checking of the integrity of the outer sheath.

* Hot dip galvanised.

5.02.02 The outdoor terminal end shall have suitable type of disconnecting link box Cable Covering Protective Unit (CCPU) to disconnect the earthing circuit during testing with sheath voltage limiter. The GIS side indoor terminal end shall have disconnecting link box (CCPU) for direct earthing.

5.02.03 The disconnecting link box shall be mounted on the galvanized supporting steel structure and provide for each circuit individually. The protective device (sheath voltage limiter) shall be of non linear resistor type and shall be made of zinc oxide compound.

5.02.04 The switchable blade shall be made of copper. All pins and disconnections shall be weather proof. All link contacts shall be of copper. They shall be self-adjusting type. The contacts shall be designed so that the pressure may not change with the normal wear and tear during operation.

5.02.05 **Bonding Cable**

Bonding cable shall be used for earthing the metallic sheath of 220kV cable and as earth continuity wire, equalizing earth level between disconnecting links. Construction and materials of bonding cable shall comply with relevant IEC or

equivalent standards and the cross sectional area shall be minimum 300mm$^2$ copper so as to withstand the short circuit rating of the cable system. The cable shall be 1.1kV grade , single core, XLPE insulated and PVC outer sheathed. / FRLS

5.02.06 **Termination/Sealing end Supporting Structure**

Supporting structure for outdoor/ indoor termination /sealing end shall consist of galvanized steel members. The supporting structures shall be uniform, clean, smooth and free from spangle as possible. All galvanizing shall comply with the requirements of the relevant IEC/IS or ASTM Standards.

* refer amendment

5.02.07 **Cable Supports and Accessories** (~~NOT IN~~ SUPPLY NOT IN BIDDER SCOPE)

5.02.07.01 Cable support system shall be pre-fabricated bolted type.

5.02.07.02 Support system for cables shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall have provision for supporting cantilever arms & cables. The support system shall be of the type as described hereunder:

a. Cable supporting steel work for cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.

b. The system shall be designed in such a way so that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares, fittings and accessories shall be prefabricated and factory galvanised.

c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form the arrangements required to support the cables. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the structural steel or insert plates will be permitted. Any cutting or welding of the galvansied surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied

d. All steel components, accessories, fittings and hardware shall be hot dip galvanized after completing welding, cutting, drilling and other machining operation.

e. The typical arrangement of flexible support system is described briefly below:

i) The main support channel and cantilever arms shall be fabricated out of rolled steel sheet conforming to IS.

ii) The length of cantilever arms shall be decided based on minimum spacing between two cables as 2D with horizontal snaking arrangement, where D = overall diameter of cable.

iii) Cantilever arms portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel

section. The back plate shall allow sufficient clearance for fixing bolt to be tightened. The exposed end portion of each cantilever shall have a rubber cap to avoid injury etc.

5.02.07.03 The support system shall be designed by the bidder to fully meet the requirements as specified. The cable support shall be designed and supplied complete in all respect with necessary embedment, hardware, cable earthing materials etc. The bidder shall submit the detailed drawings of the system offered by him including length & supporting arrangement for each cantilever arm along with the load calculations during detailed engineering.

5.02.08 **220 KV Cable Clamps**

Each cable shall be a clamped with single way aluminium clamps at each support. The material of the clamps shall be aluminum alloy in accordance with relevant IEC/IS or equivalent standards and the cable clamps shall be designed for the type, rating and diameter of cable to be clamped, as required. The cable clamp shall be bolted type into two halves and shall completely cover the cable similar to as shown in enclosed drawing as Annexure-I.

5.03.00 All accessories shall be suitable for the technical parameters as specified and shall be suitably de-rated to the site conditions.

**TECHNICAL REQUIREMENTS**

The following criteria and ratings shall apply to the design and manufacture of 220 kV Cables and Accessories:

| | | |
|---|---|---|
| 1 | Type of Cables | Cross-linked polyethylene insulated |
| 2 | No. of Cores | Single. |
| 3 | Conductor size | 400 sq. mm |
| 4 | Conductor material | Copper |
| | Shape | Compacted Circular |
| | Conductor Screen | Extruded semi conducting compound |
| | Insulation Material | Extruded Cross Linked poly Ethylene (XLPE) |
| | Insulation Screen | Extruded semi conducting compound |
| | Bedding | Layer of swellable semi conducting tape(s) to form water barrier |
| | Metallic Sheath | Aluminium or lead with copper wires screen and copper binder tape as per requirement |

| | | |
|---|---|---|
| | Outer Sheath | Flame retardant Polyethylene (PE) / FRLS PVC |
| 5 | Normal system voltage | 220KV |
| 6 | Maximum system voltage | 245kV |
| 7 | Rated Short Circuit Withstand Current at a rated voltage for 1 second | 40kA r.m.s |
| | Dynamic Short Circuit Withstand Current | 100 kA(peak) |
| 8 | System frequency | 50hz |
| 9 | Frequency variation | +3% to -5% |
| 10 | Rated continuous Current | 650 Amp. |
| 11 | Overload capacity | Nil |
| 12 | Maximum allowable temperature for cable and accessories. | As per IEC |
| | Operating Temperature of conductor: Maximum permissible temperature during normal operation under combined effect of ambient and maximum load | 90 deg C |
| | Maximum permissible temperature during short circuit under combined effect of ambient and maximum load (with conductor temperature at inception of short circuit as 90 deg. C). | 250 deg C |
| 13 | Basic impulse insulation level (1.2/50 micro second wave) | 1050 kV (peak) |
| 14 | Power frequency withstand voltage | 460 kV |
| 15 | Laying conditions | |
| (a) | Laid on cable racks in cable trench with suitable spacing between cables | 2d mm centre to centre (typical) where "d" is overall diameter of finished cable |
| (b) | Earthing of screen | |
| | -GIS end | Solidly earthed link box (CCPU) without SVL (sheath voltage limiter). |
| | -Pothead Yard end | Solidly earthed link box (CCPU) with SVL (sheath voltage limiter) |
| (c) | Ambient air temp. | 40 deg. C |
| (d) | Type of atmosphere | Heavily polluted |

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| **6.00.00** | **INSTALLATION WORK AT SITE** |
| 6.01.00 | Cable installation shall be carried out generally as per applicable standard/ manufacturer's guidelines. |
| 6.02.00 | Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall the drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For un-reeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out from over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture. |
| 6.03.00 | While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangement. Pulling tension shall not exceed the values recommended by cable Manufacturer. Cable ends shall be kept sealed by heat shrinkable PVC caps to prevent damage and ingress of moisture. Selection of cable drums for each run shall be so planned so as to avoid straight through joints. Cable splices will not be allowed except where called for by the drawings or is unavoidable and permitted by the Project Manager. Care should be taken while laying the cables so as to avoid damage to cables. |
| 6.04.00 | Bending radii for cables shall be as per manufacturer's recommendations. Manufacturer's instructions shall be strictly adhered to and necessary conducting medium for checking healthiness of outer sheath shall be applied. |
| 6.06.00 | In each cable run, extra length shall be kept at suitable point to enable two straight joints to be made, should the cable develop fault at a later stage. |
| 6.07.00 | Bidder shall ensure that the drawings, instructions and recommendations are correctly followed to avoid damage to the equipment. |
| 6.08.00 | Bidder shall carry out the bonding of screen at the both ends of terminal using the insulated conductor of required size with earth mat. |
| 6.09.00 | The bidder shall ensure that the cables and accessories supplied by him are installed in a neat workman-like manner such that it is levelled, properly aligned and well oriented. The tolerance shall be as established in the bidder's drawing and/or as stipulated by the Employer. |
| 6.10.00 | The cable termination work shall be carried out by an experienced cable jointer who shall have adequate experience in jointing and termination of 220kV or higher grade XLPE cables. The successful bidder shall submit, sufficiently in advance, the bio-data of the cable jointer giving the details of his qualification and experience for employer's approval. |

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|---|---|
| 6.11.00 | In order to identify the phases and circuits the identification tags shall be provided at each end of the cable as well as at an interval of 100m in the cable length for each phase and circuit. |
| **7.00.00** | **TESTS** |
| **7.01.00** | **TESTS FOR 220KV CABLES:** |
| 7.01.01 | The bidder shall clearly specify compliance to conducting all tests at works and at site and shall make necessary arrangement for testing equipment, as required, for works & site testing. |
| 7.01.02 | All Type tests, Routine tests and Acceptance tests shall be conducted on 220KV cables shall be in accordance with IEC 62067, Technical specifications and other relevant standards. |
| 7.01.03 | a) Additional acceptance tests (1 sample/offered lot) shall be carried out for ovality & Eccentricity, Tensile Strength and Elongation on insulation and outer sheath before and after ageing & Thermal stability on outer sheath.<br>b) The following tests shall be carried out on one length of each size of offered lot.<br>i) Surface finish and length measurement. |
| **7.02.00** | **TESTS FOR 220KV CABLES ACCESSORIES:** |
| 7.02.01 | All Type Test for 220Kv cables Accessories shall be in accordance with IEC 62067 / IEC 61462 as applicable. |
| 7.02.02 | The bidder shall clearly specify compliance to conducting all tests at works and at site and shall make necessary arrangement for testing equipment, as required, for works & site testing. |
| 7.02.03 | Routine tests and Acceptance tests on the accessories shall be in accordance with standard IEC 62067/ IEC 61462 as applicable. |
| **7.03.00** | **TYPE TESTS FOR CABLE SUPPORT SYSTEM:**<br>The type test for cable support system shall be as follows:<br>a) Load test<br>b) Vertical support, channel nut slip characteristics<br>c) Weld integrity test<br>The detailed arrangement for test setup, method core testing and allowable defection /values shall be finalized during detailed engineering as per NTPC requirements.<br>Modification if |

**7.04.00** **SITE TESTS**

Following site tests shall be carried out by the bidder and all the equipment required for the site tests shall be arranged by the bidder.

a) HV test as per clause 14.2 of IEC 62067.

b) After completion of installation non metallic outer sheath shall be tested in accordance with clause- 5 of IEC 60229.

c) The insulation resistance of the cable shall be checked before & after the HV test on cable.

d) The core resistance shall be measured and the value corrected in accordance with clause 5 of IEC 60228.

All tests shall be conducted after laying of cables and installation of accessories in accordance with IEC-62067.

**8.00.00** **PACKING & SHIPMENT**

8.01.00 Immediately after the completion of tests at works both ends of the cables shall be sealed with suitable end caps to prevent the ingress of moisture, dir and insects. Each length of cable shall be supplied on a seaworthy robust steel drum.

8.02.00 Drums or part of drums made from ferrous metals shall be treated with suitable rust preventive finish of coating to avoid rusting, during transit or storage.

8.03.00 Indoor and outdoor cable accessories, cable support systems and other associated items shall be packed in robust wooden or suitable cases. Hydrophobic materials shall be dully protected from sea water or rain during transportation and storage.

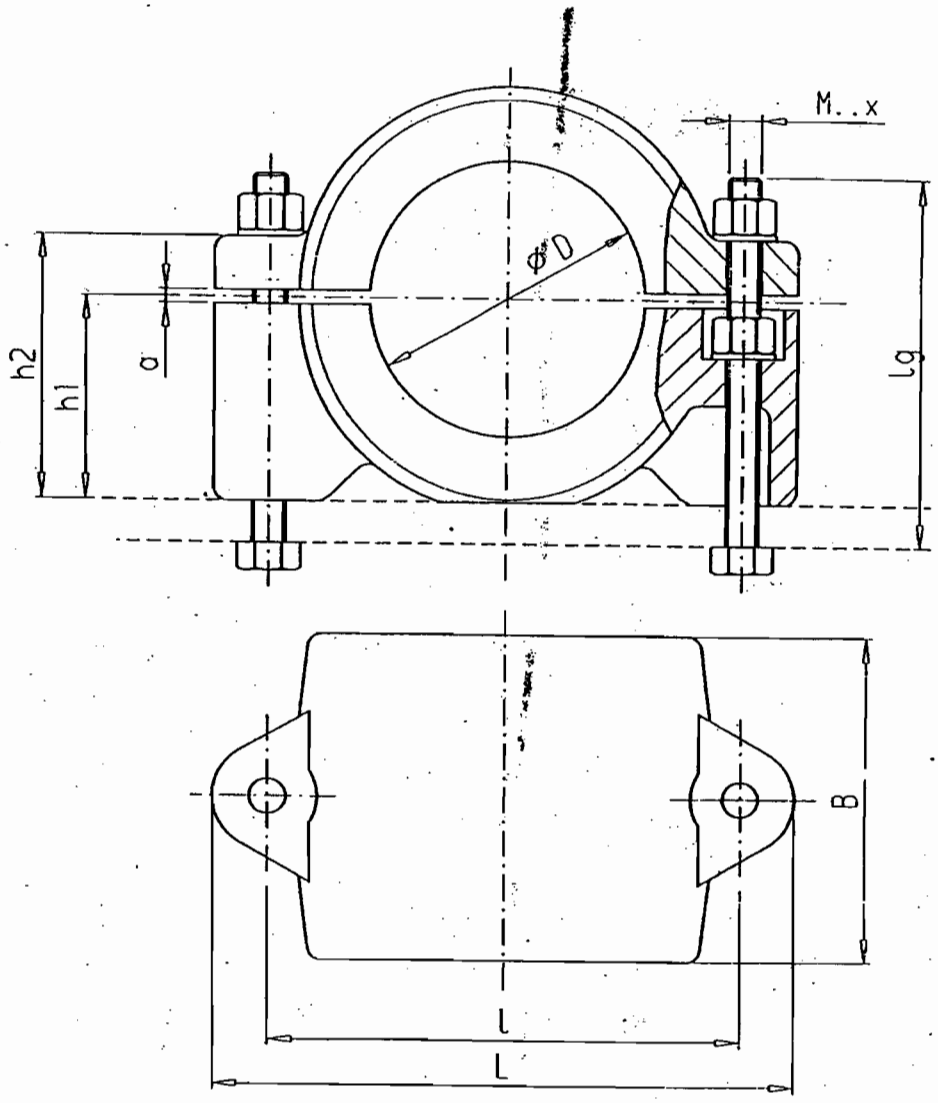
8.04.00 The bonding cable shall be supplied on wooden /steel drum.

8.05.00 Shipping dimensions of cable drums shall be as large as practicable but within transport limitations specified.

8.06.00 The construction of cable drums shall be suitable for convenient handling of drums during loading/ unloading, in transit and storage & laying at site. The cable drums shall be suitable for wheel mounting.

8.07.00 The supplier shall indicate the methods of storage of cable drums and accessories at site during detailed design stage.

ANNEXURE -I




material clamp: aluminium alloy

## SECTION- 3

## PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS

### 3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

### 3.1 PROJECT INFORMATION:

| | Particular | Details |
|---|---|---|
| a) | Customer | NTPC HYDRO LTD. |
| b) | Project Title | Lata Tapovan Hydro Hydro Electric project (3x57 MW) |
| c) | Location | Lata village in Chamoli district (Uttracnchal) |
| d) | Distance from Nearest Town - | 27 km from Joshimath (6060 ft above mean sea level) |
| e) | Approach/access road | NH-58 |
| f) | Nearest Airport & Distance | Dehradun |
| g) | Nearest Railway Station | Rishikesh |
| **SITE CONDITIONS** | | |
| a) | Max. ambient air temp. | 27°C |
| b) | Max temp of air in winter | 12°C |
| c) | Min temp of air in winter | -20°C |
| d) | Max. design ambient temp. | 40°C |
| e) | Max relative humidity | 95% |
| f) | Min relative humidity | <35% |
| g) | Site elevation | GIS - 1819 m, Pothead yard 1895 m above MSL |
| h) | Pollution Severity | Moderate Pollution level (25mm/kV) |
| i) | Average rainfall per year | 1625 mm |
| j) | Thunderstorms | Throughout the year |
| | | |
| **WIND DATA** | | |
| a) | Wind zone | 2 (As per geographical location of the project) |
| b) | Reliability level | 2 |
| c) | Category of terrain | 2 |

Basic seismic co-efficient for horizontal & vertical accelerations shall be adopted as 0.36 g and 0.24 g respectively.

### 3.1.1 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 220 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.

All eqpt shall be suitably designed and treated for normal life and satisfactory operation under high altitude conditions prevalent at site. All eqpt shall be specially treated for with high altitude correction factor and the materials and methods for this treatment shall be got approved in advance. The equipment and each part of it shall be strong enough and sufficiently well connected to resist total operating stresses, including any stresses resulting from earthquake in any horizontal direction. Electrical clearances adopted due to high altitude need to be justified with supporting calculations and got approved from the employer.

All eqpt and material shall in general conform to the latest edition of relevant national and International Codes & Standards, especially the Indian Statutory regulations.

All equipments(outdoor) shall be suitable for hot line washing.

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, short circuit etc for the equipment.

The equipment shall also comply with the following:

b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked”".

a) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

### 3.1.2 SWITCHGEARS AND BUS DUCTS

The switchgears and bus ducts shall be sized based on transformer ratings at minimum tap. In hazardous areas the fixtures/switchboards shall also be flame proof.

### 3.1.3 SYSTEM PARAMETERS:

| Sl.No. | Parameters | **GIS** | **AIS** |
|---|---|---|---|
| 1 | Highest system voltage | 245 kV rms | 245 kV rms |
| 2 | System frequency | 50 Hz | 50 Hz |

| | | | |
|---|---|---|---|
| 3 | Lightning Impulse voltage | | |
| | Phase to earth & between phases | 1050 kV | 1050 kV |
| | Across isolating distance | 1200 kV | 1200 kV |
| 3 | Switching impulse voltage | ±1050kVp | ±1050kVp |
| | Phase to earth | NA | NA |
| | Across isolating distance | NA | NA |
| | Between phase | NA | NA |
| 4 | Power frequency withstand for 1 min (rms) | | |
| | Phase to earth & between phases | 460 kV | 460 kV |
| | Across isolating distance | 530 kV | 530 kV |
| 5 | Max. fault level (1 sec.) | 40 kA | 40 kA |
| | PD level of GIS conductor | < 5 micro coulomb | < 5 micro coulomb |
| 6 | Minimum creepage distance | 25 mm/KV | 25 mm/KV |
| 6 | Corona Extinction voltage | NA | NA |

The values of insulation level given above are applicable to altitude of 1000 m. Bidder shall appropriately correct the values as per the site altitude.

**Clearances**

The minimum clearances for 220 KV outdoor switchyard shall be as given below:

220kV

| | |
|---|---|
| Phase to earth clearance | 2300 mm |
| Phase to phase clearance | 2700 mm |
| Section Clearance | 4300 mm |
| Ground clearance | 5500 mm |

The above clearances are valid upto altitude 1000 m only. Bidder shall provide adequate clearances considering the altitude correction factor for the site.

### 3.1.4 AUXILIARY POWER:

| Normal Voltage | Variation in Voltage | Frequency in Hz | Phase/Wire | Neutral Connection |
|---|---|---|---|---|
| 415 Volts | ± 10% | 50 +3%, -5% | 3Phase 4wire | Solidly earthed |
| 220 Volts | +10%, -15% | DC | --- | Isolated 2 wire system |

Combined variation of voltage and frequency shall be limited to ± 10%. Fault level of 415V system shall not be less than 45kA.

AC control supply shall be 110 V.

The minimum height of equipment supports shall be 2550mm. The various minimum heights of the switchyard shall be as given below from plinth level:

| Voltage | Equipment /1st Level | 2nd Level | 3rd Level |
|---|---|---|---|
| 132kV | 4600mm | 8000mm | 12000mm |
| 400kV (1½breaker) | 8000mm | 16000mm | -- |

### 3.1.5 Cables

Cables shall be derated for the site ambient and ground temperatures, grouping, soil resistivity and cable laying configuration.

### 3.1.6 DEVIATIONS FROM SPECIFICATIONS

Deviation, if any, from any these specifications shall be listed out separately. Bidder shall attach a separate sheet titled as "DEVIATIONS FROM SPECIFICATIONS" and list all deviations details of each deviation Section wise and Clause wise. In absence of any deviation listed out separately, adherence the specifications shall be assumed.

### 3.1.7 Enclosures:

1. PROJECT INFORMATION: NTPC Specification PART-A, Sub-Section-I (pg1 to 6)
2. General Technical Requirements are as per PART -C of NTPC Technical Specification (pg 1 to 95)
3. Amendment to above section
4. Manufacturing Quality Plan format (ANNEXURE- Q3) - (1 Sheet)
5. Field Quality Plan format(ANNEXURE- Q5) - (1 Sheet)
6. Quality Co-Ordination Procedure - To be informed during detailed engineering stage
7. General contract conditions regarding spares ( pg 10-14,27-34 of section - IV(GCC)) (Annexure- G2,G3,G4A,G5,G6)
8. Erection conditions of contract (NTPC spec section VI, Part-D, pg 29-36)

ANNEQURE – 41

| CLAUSE NO. | PROJECT INFORMATION | |
|---|---|---|

## CONTENT

**1.00.00 GENERAL FEATURES OF THE PROJECT**

1.01.00 **General**

Lata Tapovan Hydro Electric Project is a run of the river scheme across the river Dhauliganga in the district of Chamoli. The scheme involves construction of barrage on river Dhauliganga near village Lata with 4.8 m diameter, 7.3 Km. long horse shoe shaped HRT, 305.5 m long tailrace tunnel and underground power house. The installed capacity of the project is 171 MW (3x57 MW). The geo-coordinates of barrage site at Lata Tapovan is Longitude 70° 43'5"and Latitude30°31'5" . Source of the water supply is the Dhauliganga river which is the important tributary of the Alaknanda river, Alaknanda in turn is a major tributary of the Ganges. The river originates from the glacial ranges in the northern Chamoli district and drains a catchment of about 2275 sq. KM upto the barrage site of Lata. Snow bound catchment area is 1400 sq. KM

1.02.00 **Hydraulic and Civil features**

The Lata Tapovan Hydro Electric Project located on Dhauliganga river is developed as a run of river scheme by constructing a barrage with 7.3 km long head race tunnel of horse shoe type having a diameter of 4.8 m to carry design discharge of 68.9 m3/s , one number restricted orifice type surge tank with 7.0 m finished diameter and 140 m height, one no. pressure shafts of 3.8 M diameter emanating from surge tank run for a length of about 299.5 M before trifurcating into three number penstocks each 2.2 M diameter to feed each unit of 57 MW capacity to operate under a design head of 277.65 m.

The general layout of the scheme is indicated in the enclosed drawings Drg.No. 5601-002-P-E-C-A-513 REV 1 General Layout Plan of Power House Complex, Drg.No. 5601-002-P-E-C-A-501 Location Map and Drg.No.5601-002-P-E-C-A-503 REV 1 General Layout Plan of the Project.

**2.00.00 SYSTEM DETAILS**

2.01.00 The synchronous generators are proposed to be connected to single phase Generator Transformers(11/230/√3kV) through isolated phase bus ducts and Generator Circuit Breakers housed in the interconnecting tunnels between Power House cavern & transformer cavern. The HV terminals of Generator Transformers will be connected with the 220 kV GIS located on a floor above the transformer hall. The connection between 220 kV GIS and 220 kV Air Insulated pot-head yard will be through 220 kV XLPE cables. Power from the project will evacuated through two nos. 220 kV lines to proposed Joshimath Substation.

2.02.00 The power supply for unit auxiliaries is proposed to be obtained from dry type 500KVA, 3 PHASE, 11KV/0.433KV Unit Auxiliary Transformers. The arrangement of black start of the generating units & emergency supply to feed the unit auxiliaries and station auxiliaries is shown in the enclosed drawing, Drg.No. 5601-003-P-E-E-A-701 "Single Line Diagram for overall Electrical System".

2.03.00 **E.O.T. Crane** Not in bidders Scope.

One no. E.O.T. Crane of 165/25 T capacity with main and auxiliary hooks is proposed to be installed in the power house for handling assembly and erection of generating units & associated equipment. The clearances, limits for hook approach and other dimensions of the crane shall be suitable for the proposed layout of this power station. One no EOT crane of 75/20T in Butterfly Valve House building and one EOT crane of 10T shall be provided in GIS Hall.

**3.00.00 CLIMATIC CONDITIONS**

The barrage of the project is situated at an altitude of about 2088m. The Power House service bay floor is located at EL 2031 m & the invert level of the draft tube is expected to be at EL 1790 m. The climatic conditions are given below:: -

| | | | |
|---|---|---|---|
| i) | Maximum temperature of air in summer | : | 27° C |
| ii) | Maximum temperature of air in winter | : | 12°C |
| iii) | Minimum temperature of air in winter | : | Sub zero |
| iv) | Maximum Relative humidity | : | >70 % |
| v) | Minimum Relative humidity | : | <35 % |
| vi) | Average rain fall per year | : | 1625 mm |
| vii) | Thunderstorms | : | Throughout the year |

**4.00.00 SEISMIC FORCES**

The equipment shall be designed to withstand seismic forces. Uttarakhand State comes under Seismic Zones V and IV of Seismic Zoning Map of India, which correspond to Zone Factors of 0.36 and 0.24 (effective peak ground acceleration in terms of g) of seismic intensities VIII and >IX (MSK-64 scale), respectively (IS 1893,2002).

**5.00.00 HIGH ALTITUDE CORRECTION FACTOR**

All equipment shall be suitably designed and treated for normal life & satisfactory operation under high altitude conditions prevalent at the site. All electrical auxiliary equipment shall be specially treated with high altitude correction factor and the materials and method for this treatment shall be got approved in advance. The equipment and each part of it shall be strong enough and sufficiently well connected to resist total operating stresses, including any stresses resulting from an earthquake in any horizontal direction. Electrical clearances adopted due to high attitude need to be justified with supporting calculations and got approved from the Employer.

**6.00.00 WATER ANALYSIS/ PETROLOGICAL ANALYSIS OF RIVER SEDIMENT**

6.01.00 Water Analysis for Dhauliganga River is given below in Table 1: .

TABLE- 1- Water Analysis for Dhauliganga River

| Property | Value |
|---|---|
| Total amount of water(l) | 12.262 |
| Weight of silt(g) | 73.687 |
| Sediment present(g/l) | 6.0094 |
| In ppm | 6009.4 |
| In (%) | 0.6009 |
| In (cc/l) | 4.2924 |
| pH at 33.4 deg C | 7.62 |

6.02.00 **Petrography Examination for Silt**

a) Megascopic Observation

The silt is brownish gray in color. It is composed of loose grains of fine sand to medium silt and clay with flakes of mica as tiny specks. The fine aggregate of the of sample consists of quartz mica (muscovite), Ferro magnesium minerals (dark colored grains). The quartz and mica flakes are clearly observed in the coarser fraction of the sample.

b) Microscopic Examination

Under microscope the minerals identified in the -45μ to -90μ fraction are quartz, feldspar, lithic fragments, hornblende, biotite, magnetite and tourmaline. A few of the quartz grains are coated with iron oxide.

Other properties are as follows:

Shape of quartz grain - Angular to sub angular

Packing of quartz grains - Loosely Packed

Spherecity of Quartz - High

6.03.00 **Grain Size Analysis**

| Sieve Analysis, % by mass (Using IS: Sieve) | Results |
|---|---|
| + 2.33 mm sieve | 0.00 |
| -2.36 mm +1.18 mm sieve | 0.06 |
| -1.18 mm +600 micron sieve | 0.90 |
| -600 micron + 300 micron sieve | 5.20 |
| -300 micron + 150 micron sieve | 18.94 |
| -150 micron + 75 micron sieve | 24.56 |
| -75 micron + 63 micron sieve | 10.02 |
| - 63 micron sieve | 40.32 |

Mineralogical composition (in%) of sediments

| S.No | Grain Size (micron | Quartz (H=7) | Tourmaline (H=7-7.5) | Lithic Fragments (H=7) | Feldspar (H=6-6.5) | Magnetite (H=6-6.5) | Hornblende (H =5.5) | Biotite (H= 2.5) |
|---|---|---|---|---|---|---|---|---|
| 1 | +45 to -90 | 66-67 | 1-2 | 4-5 | 7-8 | 5-7 | 2-3 | 8-9 |
| 2 | +45 to -90 | 88-67 | 1-2 | 3-4 | 7-8 | 5-7 | 2-3 | 8-9 |

**7.00.00 TRANSPORTATION**

7.01.00 **Location and Access**

Lata Tapovan H.E. Project is located on Dhauliganga river in the Chamoli District of Uttarakhand State. The nearest Railway head of the project is Rishikesh .The project can be accessed from Joshimath, located at an elevation of about 6060 ft above the mean sea leval. The headworks site of the project is located at Lata which is 27 km from Joshimath and the power house site is located about 16 km from Joshimath on the Joshimath Malari road.

The nearest Airport is at Dehradun and the approach/access road to project is National Highway 58. The road runs parallel to the river course of Dhauliganga on the left bank and is constructed and maintained by BRO. The project components are located on the right bank of the Dhauliganga river between the places Lata &

Tapovan, while the road runs parallel to the river on the left bank. Presently there is no vehicular access to the right bank of the project site. Two bridges along with access roads from the adjacent Joshimath- Malari highway are being constructed to connect the right bank to the left bank, one at powerhouse site and the other near Lata village.

7.02.00 **Transport Limitations**

The weights and dimension of the packages for transportation to site shall be limited to the following:-

a) Max. Weight of the package not to exceed 50 M.T.

b) Max. Size of the package not to exceed L = 8500 mm, W= 3000 mm, and H= 6000 mm.

The above information is tentative and it is the contractor's responsibility to verify the actual transport limitation.

**8.00.00 BIDDER TO INFORM HIMSELF**

The Bidder shall make independent/their own investigations about the conditions and circumstances affecting his tender estimates and about the possibility of executing the works as described. During the evaluation of tenders, it shall be presumed that the Bidder have inspected and examined the site and its surroundings and to have satisfied themselves about the form and nature of the site, the quantities and materials necessary for the completion of the work and the means of transport and access to site, the requirements of accommodation, general labor position at the site and have quoted their prices after taking into account, the risks, contingencies and other circumstances which may influence or affect the execution of the Contract.

Access to the site shall be allowed, to the prospective bidder(s) by prior appointment with the Employer.

## CONTENTS

**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 along with 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 a turnkey contract. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure 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 personal, 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 similar standard components/ parts of similar standard equipment provided shall be interchangeable with one another.

**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) Bureau of Indian Standards (BIS)

b) Indian Electricity Act

c) Indian Electricity Rules

d) Indian Explosives Act

e) Indian Factories Act and State Factories Act

f) Indian Boiler Regulations (IBR)

g) Regulations of the Central Pollution Control Board, India

h) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

i) Pollution Control Regulations of Department of Environment, Government of India

j) State Pollution Control Board.

k) Rules for Electrical installation by Tariff Advisory Committee.

l) Any other statutory codes / standards / regulations, as may be applicable.

5.02.00 Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere 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) Japanese Industrial Standards (JIS)

b) American National Standards Institute (ANSI)

c) American Society of Testing and Materials (ASTM)

d) American Society of Mechanical Engineers (ASME)

e) American Petroleum Institute (API)

f) Standards of the Hydraulic Institute , U.S.A.

g) International Organisation for Standardisation (ISO)

h) Tubular Exchanger Manufacturer's Association (TEMA)

i) American Welding Society (AWS)

j) National Electrical Manufacturers Association (NEMA)

k) National Fire Protection Association (NFPA)

l) International Electro-Technical Commission (IEC)

m) Expansion Joint Manufacturers Association (EJMA)

n) Heat Exchange Institute (HEI)

o) International Telecommunication Union (ITU)

p) Euronorms (ITU)

q) Association Francaise de Normalisation (AFNOR)

r) Deutsche Industries Normen (DIN)

s) Verein Deutscher Elektriker (VDE)

t) Verein Deutscher ingenieure (VDI)

u) British Standards (BS)

v) American Iron and Steel Institute (AISI)

w) Institute of Electrical Engineer (IEE)

x) Institute of Electrical and Electronic Engineers (IEEE)

y) American Society of Heating, Refrigerating and Air-Conditioning Engineers

z) Consultative committee for International Telegraphy or Telephony (CCITT)

aa) Groupe d'e' tuede, Cahier des Charges Hydrauliques (CCH)

5.03.00 Other International/ National standards such as DIN, VDI, BS, etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, along with the offer, 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 under 5.01.00 and 5.02.00 together with the complete word to word translation of the standard that is normally not published in English.

| | |
|---|---|
| 5.04.00 | As regards highly standardized equipments such as Hydro Turbine and Generator, National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VDI shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered. |
| 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 | 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. |
| 5.07.00 | 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 given in the Annexure-I to this section. |
| **6.00.00** | **EQUIPMENT FUNCTIONAL GUARANTEE** |
| 6.01.00 | The functional guarantees of the equipment under the scope of the Contract are given in Section-VI Part - A 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**<br><br>All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.<br><br>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 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 Availability 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 shall be specified in terms of running 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 a turnkey 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 as per the scope defined in various sections of the Technical-Specifications.

The Contractor shall furnish engineering data in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.

8.02.00 The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in Annexure-II to this Part-C, Section-VI of the Technical Specification.

8.03.00 **Engineering Information Submission Schedule**

Prior to the award of Contract, a Detailed Engineering Information Submission Schedule shall be tied up with the Employer. For this, the bidder shall furnish a detailed list of engineering information along with the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorised into the following parts.

i) Information that shall be submitted for the approval to the Employer before proceeding further, and

ii) Information that would be submitted for Employer's information only.

The Engineering Information Schedule shall be updated month wise.

The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress. The review of these data by the Employer will cover only general conformance of the data to the specifications and documents interfaces with the equipment provided under specifications. This review by the Employer may not indicate a thorough review of **all** dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Project Manager shall not be construed by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Documents and the entire works covered under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Employer in writing.

8.03.01 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:

A) **Basic Engineering Documentation**

Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:

i) System description of all the mechanical, electrical, control & instrumentation.

ii) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations along with all calculations justifying and identifying the sizing and the design margins.

iii) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups.

iv) Operation Philosophy and the control philosophy of the Main Plant and other plants.

v) 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 to the Employer for engineering of areas not included in bidder's scope.

vi) Basic layouts and cross sections of the main plant building (various floor elevations) and other areas including interface-areas included in the scope of the bidder.

vii) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs), which shall then be mutually discussed & finalised with the Employer.

B) **Detailed Engineering Documents**

i) General layout plan of the station.

ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.

iii) Flow diagrams, Process & Instrumentation Diagrams

iv) Piping composite layout drawings.

v) Purchase specifications/ 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.

vi) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries.

vii) Transient & hydraulic analysis of piping and system wherever applicable.

viii) Comprehensive list of all terminal points which interface with Employer's facilities giving details of location, end connection details, forces, moments etc.

ix) Power supply single line diagram, block logics, control schematics, electrical schematics, etc.

x) Protection system diagrams and relay settings.

xi) Cables schedules and interconnection diagrams.

xii) Cable routing plan.

xiii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, installation drawings for field mounted 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.

xiv) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points.

xv) Sequence and protection interlock schemes.

xvi) Type test reports, insulation co-ordination study report and power system stability study report.

xvii) Control system configuration diagrams and card circuit diagrams and maintenance details.

xviii) Detailed software manuals & source software listing.

xix) Detailed flow chart for digital control system.

xx) Mimic diagram layout.

xxi) Model study reports wherever applicable.

xxii) Functional & guarantee test procedures and test reports.

xxiii) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

xxiv) For equipment foundation, seperate composit general arrangement drawings for equipment foundation shall be furnished by the bidder including the location of pockets/bolts/inserts/embedments/pedestals and extent of grouting, point of application of loads etc.

The Contractor's 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.

8.04.00 **Engineering Drawings**

(a) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-II of Part-C. The soft copies to be supplied shall be either in CDs, DVD or through direct transfer via E-mail, etc. The drawings submitted for approval could be in the image form.

(b) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate 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.

(c) Each drawing submitted by the Contractor (including those of sub vendors) 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 and 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 drawings shall be in English. All the dimensions should be in metric units.

(d) The drawings submitted by the Contractor (or their sub vendor's) 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.

The Contractor shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings / documents / calculations envisaged to be furnished by him during the detailed engineering to the Employer. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".

Similarly, all the drawings / documents submitted by the Contractor during detailed engineering stage shall be stamped "FOR APPROVAL" or "FOR INFORMATION" prior to submission.

(e) 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.

(f) After the approval of the drawings, further work by the Contractoor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.

(g) 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 changes are necessitated in the design of the equipments / system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specifications.

(h) 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.

(i) Drawing 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. 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.

(j) 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.

8.05.00 **Instruction Manuals**

The Contractor shall submit to the Employer, draft Instruction Manuals for all the equipments covered under the Contract by the end of one year from the date of his acceptance of the 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-II. 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 atleast 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.

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**

i) The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall be in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment including, operation, maintenance, dismantling and repair. Each manual shall also include a complete set of drawings together with performance/rating curves of the equipment and test certificates wherever applicable. The contract shall not be considered to be completed for purposes for taking over until these manuals have been supplied to the Employer.

ii) If after the commissioning and initial operation of the plant, the manuals require any modification/ additions/ changes, the same shall be incorporated and the updated final instruction manuals shall be submitted to the Employer for records.

iii) A separate section of the manual shall be for each size/ type of equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.

iv) The manuals shall include the following

a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.

b) 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.

c) Where applicable, fault location charts shall be included to facilitate finding the cause of maloperation or break down.

v) Detailed specifications for all the consumables including lubricant oils, greases, chemicals etc. required for the complete plant.

vi) On completion of erection, a complete list of bearings/equipment giving their location, and identification marks etc. shall also be furnished to the Employer.

8.06.00 **Plant Handbook and Project Completion Report**

8.06.01 **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, equipments and systems covering the complete project including

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 main plant building and auxiliary buildings

viii) Important Do's & Don't's

The plant handbook shall be submitted within twelve (12) 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.

8.06.02 **Project Completion Report**

The Contractor shall submit a Project Completion Report at the time of handing over the plant.

8.07.00 **Engineering Progress and Exception Report**

8.07.01 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 four (4) weeks after the date of first submission

b) Drawings which were not submitted as per agreed schedule.

8.07.02 The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.

8.08.00 **Clearance of Employers' Drawings:**

During detailed Engineering contractor will check the interface of relevant structural general arrangement drawings, foundation drawings, RCC drawings and architectural plan/elevation drawings furnished by the Employer for various areas and forward his consolidated observations/comments within three (3) weeks from the date of forwarding the drawings by 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 six (6) weeks after it's 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**

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 The Bidder's scope includes all the first fill including the necessary quantity for the flushing of oils, lubricants, servo fluids, gases essential chemicals etc. Consumption of all these consumables during the initial operation and final filling after the initial operation shall also be included in the scope of the Bidder. Bidder shall also supply necessary quantity for the first change of consumables such as oils, lubricants, servo fluids, gases, essential chemical etc. This additional quantity shall be supplied in separate Containers.

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 along with 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.

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| **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** |
| 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 non-hygroscopic 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 | 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. |
| 16.05.00 | 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** |
| | 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. A list of such tools and tackles shall be submitted by the Bidder along with the offer.<br><br>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. In case these tools and tackles are used by the Contractor during erection, commissioning or initial operation the same shall be refurbished repaired/replaced as required to the satisfaction of the Employer before handing over to the Employer. All the tools and tackles shall be of reputed make acceptable to the Employer. |

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| **18.00.00** | **WELDING** |
| 18.01.00 | If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be performed by others the requirements shall be submitted to the Employer in advance of commencement of erection work. |
| **19.00.00** | **COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES** |
| 19.01.00 | All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with colour and coding scheme given in Annexure-III enclosed. |
| 19.02.00 | **Surface Treatment and Coatings**<br><br>Please refer Annexure-IV of this sub-section. |
| **20.00.00** | **PROTECTION** |
| 20.01.00 | 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 pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. |
| **21.00.00** | **QUALITY ASSURANCE PROGRAMME** |
| 20.01.00 | The Contractor shall adopt suitable quality assurance programme to ensure that the 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/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with IS/ISO-9001. A quality assurance programme of the contractor shall generally cover the following:<br><br>i) His organisation structure for the management and implementation of the proposed quality assurance programme<br><br>ii) Quality System Manual<br><br>iii) Design Control System<br><br>iv) Documentation and Data Control System<br><br>v) Qualification data for Bidder's key Personnel. |

vi) The 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.

vii) System for shop manufacturing and site erection controls including process, fabrication and assembly.

viii) Control of non-conforming items and system for corrective actions and resolution of deviations.

ix) Inspection and test procedure both for manufacture and field activities.

x) Control of calibration and testing of measuring testing equipments.

xi) System for Quality Audits.

xii) System for identification and appraisal of inspection status.

xiii) System for authorising release of manufactured product to the Employer.

xiv) System for handling, storage and delivery.

xv) System for maintenance of records, and

xvi) 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.

**21.02.00 GENERAL REQUIREMENTS - QUALITY ASSURANCE**

21.02.01 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.

21.02.02 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

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| | 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 e.g. floppy or E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD ROM. |
| 21.02.03 | 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 starting from receipt of materials/equipment at site. |
| 21.02.04 | The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans alongwith Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved 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 in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer alongwith technical justification for approval and dispositioning. |
| 21.02.05 | No material shall be despatched from the manufacturer's works before the same is accepted, subsequent to predespatch 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). |
| 21.02.06 | 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. |

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| 21.02.07 | 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. |
| 21.02.08 | 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.<br><br>All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing. |
| 21.02.09 | All brazers, welders and welding operators employed on any part of the contract either in Contractor's/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. |
| 21.02.10 | Welding procedure qualification & Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative. |
| 21.02.11 | Any other statutory requirements as applicable for the equipments/systems shall also be complied with. |
| 21.02.12 | Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only. |
| 21.02.13 | No welding shall be carried out on cast iron components for repair. |
| 21.02.14 | All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes. |
| 21.02.15 | 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.<br><br>All plates of thickness above 40mm & all bar stock/Forging above 40mm dia shall be ultrasonically tested. For pressure parts, plate of thickness equal to or above 25mm shall be ultrasonically tested. |

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| 21.02.16 | The Contractor shall list out all major items/ equipments/ 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 finalized 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. Monthly progress report on sub-contractor details submission / approval shall be furnished. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract. |
| 21.02.17 | 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. Within three weeks of the release of the purchase orders/contracts for such bought out items/components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract. |
| 21.02.18 | Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance. |
| 21.02.19 | 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 |

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| | parts and equipment. Contractor 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. |
| 21.02.20 | 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. |
| 21.02.21 | For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable. |
| 21.02.22 | Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative. |
| 21.03.00 | Environmental Stress Screening<br><br>All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following. |
| 21.03.01 | The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.<br><br>Or<br><br>In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% which ever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.<br><br>Elevated Temperature Test Cycle<br><br>During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service. |

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.

In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

21.03.02 Burn in Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.

The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems; the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.

**21.04.00 QA DOCUMENTATION PACKAGE**

**The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick ( √) mark.**

21.04.01 Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-

supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before despatch. However CD Rom may be issued not later than three weeks.

21.04.02 Typical contents of QA Documentation is as below:-

i) Quality Plan

ii) Material mill test reports on components as specified by the specification and approved Quality Plans.

iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

iv) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

v) Heat Treatment Certificate/Record (Time- temperature Chart)

vi) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure.

vii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.

viii) Certificate of Conformance (COC) wherever applicable.

ix) MDCC

21.04.03 Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

21.04.04 Before despatch / 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.

i) 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.

ii) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document ( or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.

iii) If a decision is made despatch, 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 3 weeks after the despatch of equipment.

**21.05.00 TRANSMISSION OF QA DOCUMENTATION**

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.

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.

**21.06.00 PROJECT MANAGER'S SUPERVISION**

21.06.01 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 and without prejudice to the provisions of 'Arbitration' clause in Section GCC of Vol.I, the Contractor shall proceed to comply with the Project Manager's decision.

21.06.02 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:

i) Interpretation of all the terms and conditions of these documents and specifications:

ii) Review and interpretation of all the Contractor's drawing, engineering data, etc.

iii) Witness or his authorised 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.

v) Inspect, accept or reject any equipment, material and work under the contract.

vi) Issue certificate of acceptance and/or progressive payment and final payment certificates

vii) Review and suggest modifications and improvement in completion schedules from time to time, and

viii) Supervise Quality Assurance Programme implementation at all stages of the works.

**21.09.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES**

21.09.01 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.

21.09.02 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.

21.09.03 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, 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 in two (2) copies.

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|---|---|
| 21.09.04 | 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 shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract. |
| 21.09.05 | 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 ten (10) working days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within ten (10) working 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. |
| 21.09.06 | 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. |
| 21.09.07 | The inspection by Project Manager / Inspector 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. |
| 21.09.08 | To facilitate advance planning of inspection in addition to giving inspection notice as above, 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. |
| 21.09.09 | All inspection, measuring and test equipments 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 the Employer. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector. |

**21.10.00** **ASSOCIATED DOCUMENTS:**

21.10.01 Manufacturing Quality Plan Format No.: QS-01-QAI-P-09/F1-R1

21.10.02 Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1

**22.00.00** **SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION**

In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also apply:

i) Working platforms should be fenced and shall have means of access.

ii) Single core electrical cables shall not be used. Only 3 Core cable for single phase supply and 4 Core for 3 phase supply shall be used.

iii) 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.

**23.00.00** **NOISE LEVEL AND VIBRATION**

For noise level please refer Annexure-VII of this part.

For vibration please refer Annexure –VIII of this part.

**24.00.00** **PRE-COMMISSIONING AND COMMISSIONING FACILITIES**

24.01.00 (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 Clause No. 30.00.00 of Part-D, 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, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.

c) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.

d) 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.

e) 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.

f) Contractor shall furnish the commissioning organisation chart for review & acceptance of employer at least eighteen months prior to the schedule date of synchronization. The chart should contain:

(i) Bio-data including experience of the commissioning engineer.

24.02.00 **Initial Operation**

a) Subsequent to 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 720* continuous hours. During the period of initial operation of 720 hours, 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.

*Shall be appropriately adjusted for any generation loss attributable to the Employer.

24.03.00 **Guarantee Tests**

a) The final test as to prove the Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's Commissioning, start-up and initial operation shall make the unit ready to conduct such test.

b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the performance guarantees.

c) For performance/ demonstration tests instrumentations of accuracy class, subject to the approval of the Employer shall be used. The numbers and location of the instruments shall be as per the specified test codes.

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 equipments have been brought out in detail in Part A and Part B of Section-VI.

24.04.00 **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 with held 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.

**25.00.00 TRAINING OF EMPLOYER'S PERSONNEL**

In addition to the requirements given in Section General Condition of contract (GCC), Section-IV regarding training of Employer's personnel, the following shall also apply.

**25.02.00 General**

The Contractor shall provide suitable instructors, training material and facilities (instruments, apparatus, simulators, documents, drawings, protective clothing, rooms, office supplies, etc.) for the Personnel made available by the Employer for training.

One month before the training start, the Employer will send the list of the trainees and any comments on the training program proposed by the Contractor. This program shall be adapted to the design and nature of the Works, and the needs of trainees. Trainees shall be suitably trained in the various aspects of design, manufacture, installation/erection, operation and maintenance, relevant to the training, of works similar to the Works

The Contractor shall supervise and provide direction to, and be liable for the acts or omissions, other than negligent or wilful misconduct of such personnel, of the Employer's trainees.

The Contractor shall provide the training described hereafter in accordance with any further specific requirements stated in the Employer's Requirements.

The Contractor shall assist the Employer in obtaining any visas and other formalities for entering or leaving the territory on which the training is being provided.

The Contractor shall bear responsibility for ensuring the safety of the trainees during their stay in the country of the training. On their part, the trainees shall comply with the laws, regulations and customs of the country in which training is being held.

In the event of illness or accident, the Contractor shall take all steps to provide the trainees with the appropriate medical care.

**25.03.00** **Training of Employer's Personnel**

The Bidder shall provide training to Employer's personnel to meet operational and maintenance requirements of various Systems/equipments supplied under this package. This shall include trainee in the areas as enclosed at Annexure-V & VI.

The scope of service under training of Employer's engineers shall include a training module covering the following:

**a) Training During Engineering/ Manufacturing Phase**

This shall cover all disciplines viz, Mechanical, Electrical, C&I & QA etc. and shall include all the related areas like Design familiarisation, 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. The training in areas of Operation and Maintenance shall take place preferably during end of manufacture/ tests.

**b) Training During the Erection / Installation / Site Work**

Independently from the supervision and inspection functions of the Employer's Representative, the Contractor shall authorise the Employer's Personnel to follow the erection / installation / site work at his site.

The Employer's Start-up Personnel shall take no part in the equipment erection and/or installation operations, which shall be exclusively carried out by the Contractor and under his entire responsibility.

This on site training shall cover each phase of erection / installation / site work and shall be of sufficient duration.

The Contractor shall supply the information or measurements concerning the erection requested by the Employer's Representative or/and by the Employer's personnel.

**c) Training during the Tests on Completion phase, Operation & Maintenance**

The scope of service under training of Customer's engineers shall necessarily include, training of upto twelve (12) Employer's personnel for the power plant in the areas of Operation & Maintenance. The Contractor shall provide on the-job training in the operation and maintenance of the Works to the Employer's Operating Personnel. Such training shall start at least 30 days prior to commencement of Tests on Completion and continue until Taking Over. Its scope and quality shall be such so that the operation and maintenance phase of the project can be carried out to ensure sustained guaranteed performance of the equal availability of the units as offered. The training should provide the trainees with comprehensive understanding of all operational and maintenance aspects of the Works. Such training shall also include safety and environmental protection aspects applicable to the Works.

25.04.00 Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal.

In all the above cases, whenever the training of Employer's personnel is arranged at the works of the manufacturers, it shall be noted that the lodging and boarding of the Employer's personnel shall be Bidder's scope. The Bidder shall make all necessary arrangements towards the same.

**26.00.00 PACKAGING AND TRANSPORTATION**

All the equipments 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. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch 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 despatch of materials for transportation.

**27.00.00 ELECTRICAL ENCLOSURE**

27.01.00 All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature of 40 degree C and a maximum relative humidity of 100%.

**28.00.00 JUNCTION BOXES**

The junction boxes shall be made of minimum 2 mm thick sheet steel. Gland plates shall be removable type and made of 3 mm thick sheet steel. The boxes shall be provided with detachable cover or hinged door with captive screws. Top of the box shall be arranged to slope towards the rear of the box. The box shall be hot dip galvanised and shall be provided with suitable neoprene gaskets to achieve requisite degree of protection. Adequate spacing shall be provided to terminate the external cables. The boxes shall be suitable for mounting on various types of steel structures. The terminal blocks provided shall be of 1100 V grade, rated for 10 A for control cables. Suitable numbering for terminal blocks shall be done. In case of junction box for power cable, the box shall be rated for maximum current carrying capacity. Terminal blocks shall be of one piece, Klippon RSF-1 or ELMEX CSLT-1 type with insulating barriers.

**29.00.00 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.

29.01.00 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:

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| 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). |
| 4. | Vacuum | - | Millimeters of mercury gauge (mm Hg) |

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| | or water column (mm Wcl).<br>5. Flow (Liquid) - LPS/LPM/LPH<br>6. Flow base - 760 mm Hg. 15 deg.C<br>7. Density - Grams per cubic centimetre. |
| 29.02.00 | 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. |
| 29.03.00 | Instruments for sensing, transmission and measuring system shall be of electronic type with signal transmission in current mode of 4-20 mA DC. For interrogation of potential free contacts, 48 V DC power supply shall be employed. |
| 29.04.00 | For sequence interlocks and equipment/ unit protection, independent and separate direct acting switches shall be provided. Indicating type process switches shall not be acceptable. Wherever blind switches are provided, separate gauges for local indication shall be provided to facilitate easy operation/ maintenance. |
| 29.05.00 | The contacts of switch devices (process switches, limit switches) etc., unless higher rating is required for specific application, shall be rated continuously for 5A at 240 V AC, 50 Hz (breaking inductive circuits) and 0.5 A at 220V DC. Each switching element including the contacts from limit and torque switches of valve actuators shall be provided with two electrically independent single pole double throw (SPDT) snap acting contacts. All spare contracts of the switch devices shall be wired to the nearest junction box/ terminal box. |
| 29.06.00 | 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. |
| 29.07.00 | All equipment/ systems located in the field shall be suitable for continuous operation without loss of function, departure from specifications or damage, at the ambient temperature of 40 deg. C and relative humidity of 95%. |
| 29.08.00 | All equipment/ systems located in air conditioned area as specified else where shall also be designed and constructed to operate for short periods of plant operation when air-conditioning equipment malfunctions (without loss of function, departure from specifications requirements or damage) at the maximum ambient temperature of40 deg C and relative humidity of 95% RH. |
| **30.00.00** | **PROTECTION CLASS OF CABINETS / PANELS, ENCLOSURES ETC.** |
| | a) All panels desks cabinets & enclosures furnished shall at least comply with the requirements of protection classes as indicated below:<br>1. In-door air -conditioned (A.C.) areas - IP22 |

2. In-door Non A.C. areas:

(a) Ventilated enclosures - IP42

(b) Non- Ventilated - IP54

3. Out-door - IP55

b) Distribution boxes, junction boxes, cold junction compensation boxes, terminal boxes and all other field mounted equipment to be furnished as per this specification shall have weather protection conforming to IP 55.

c) The design of panels. Cabinets, enclosures and packaging density of components mounted therein shall be such that the temperature rise does not exceed 10 deg C above the ambient under the worst conditions. The Contractor shall furnish during detailed engineering the necessary design calculation for Employer's review.

d) Enclosures for peripheral equipments like printers, etc. shall take care of noise and shall ensure minimum possible noise disturbance to the working personnel.

30.01.00 Permanently fastened, stainless steel, name plate stamped with the Employer's tag number and other necessary details shall be furnished on all gauges, control valves, flow devices, switch devices, temperature elements, solenoid valves, and all other devices, panels, cabinets, enclosures, console inserts etc. after Employer's approval.

**31.00.00 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-801- 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.

**32.00.00 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.

**33.00.00 INSTRUMENT AIR SYSTEM**

The instrument air supply system as supplied by the Bidder for various pneumatic

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| | control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.<br><br>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. |
| 33.01.00 | Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.<br><br>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.<br><br>The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.<br><br>i) Temperature test pockets with stub and thermowell<br><br>ii) Pressure test pockets |
| **34.00.00** | **SYSTEM DOCUMENTATION**<br><br>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 under Sub-section C&I, Part -B, Section-VI Technical Specification.<br><br>The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage. |
| 34.01.00 | 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. |
| 34.02.00 | **Electronic Module/Component Details** |

The Bidder shall have to furnish all technical details in respect of each and every electronic card/module as employed on the various solid state as well as microprocessor based systems and equipment including conventional instruments and peripheral.

ANNEXURE-I

## LIST OF STANDARDS

Abbreviations have been used for denoting International and National Standardanisation Organizations.

The Names and Address of reputed Organisations is given below.

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|---|---|
| ASA | American Standards Association<br>American National Standards Institute<br>1340 Broadway, New York, Y. N. 10018.<br>U.S.A. |
| ASTM | American Society to Testing and Materials<br>1916, Race Street, Philadelphia,<br>Pennsylvania-19103, U.S.A. |
| BS | British Standards,<br>British Standards Institution,<br>101, Pentonvile Road, London N 19 ND.<br>U.K. |
| CEE | Commission on rule for the approval of<br>Electric Equipment (Netherland),<br>Netherlands Normalisate - Institute,<br>Polkwege, Rijswijk (ZH)-2016, Netherland |
| DIN | Deutscher Normenausschuss<br>Beuth Verlag GmbH<br>Ausilieferung Burggra Fenstrape, 4-7<br>10009 Berlin 30, Germany. |
| IEC | International Electrotechnical Commission<br>Bureqa Central De la Commission<br>Electrotechnique Internationale,<br>1, Rue De Veremba Geneve Switzerland |
| IS | Indian Standards,<br>Manak Bhavan,<br>9 Bahadur Shah Safar Marg,<br>New Delhi-1. |
| ISO | International Organization for Standardization<br>Danizh Board for Standardization<br>DANSK STANDARDESRING SRAAT<br>AUREHOEGVEJ-12<br>DK 2900 JELLEPRUP, DENMARK. |

JIS Japanese Standards Institution
Japanese Standards Association, 124
Asasaka 4 Chome, Tokya 107, Japan.

SAA Standards Association of Australia
Marks Committee, SAA, P.O. Box 458,
North-Sydney, Australia.

VDE German Standards
VDE. Verlag GmbH, 1000 Berlin 12
Bissmarc-Ketrabe 33, Germany.

**LIST OF CODES**

| **Indian Standards** | **Title** | **International and Internationally recognised standard** |
|---|---|---|
| **EOT CRANES** | | |
| IS-1383 & (Part 1,2,3,4 & 5) | - | Cranes Classification |
| IS - 3177/ BS : 466 | - | Code of Practice for Electric overhead travelling cranes and gantry cranes other than steel work crane. |
| IS - 807/ BS : 2573 | - | Code of practice for design, manufacture, erection and testing (Structural portion) of cranes and hoists. |
| IS - 5749/ BS : 3017 | - | Forged Ramshorn hooks. |
| IS - 2266/ BS : 302 | - | Specifications for steel wire ropes for general engineering purposes. |
| IS – 6938 | - | Code of Practice for design of rope drum and chain hoists for hydraulic gates. |
| IS - 325/BS : 2960 | - | Three phase induction motors. |
| IS - 13947 (Part 4/sec 1) | - | Contactors and motor starters - Electromechanical contactors & motor starter. |
| IS – 3815 | - | Point hooks with shanks for general engineering purpose. |
| IS – 1030 | - | Carbon steel castings for general engineering purposes. |

| | | |
|---|---|---|
| IS – 1875 | - | Carbon steel billets, bloom, slabs and bars for forgings. |
| IS – 210 | - | Grey Iron castings. |
| IS - 4460 (Part 1,2,3) | - | Gears - spur & helical gears - calculation of load capacity. |

**FIRE DETECTION, SAFETY AND FIRE PROTECTION SYSTEM**

**Overall scope of the work**

| | | |
|---|---|---|
| NFPA 851 | : | Recommended practice for fire protection for hydroelectric generating plants. |
| NFPA 72 | : | National Fire Alarm Code |
| NFPA 72 E | : | National Fire Alarm Code |
| NFPA 70 | : | National Electrical Code |
| NFPA 101 | : | Life Safety Code |
| IS 1646 | : | Code of practice for Fire safety for buildings (General): Electrical installation |
| IS 5571 | : | Guide for Selection of Electrical equipment in hazardous areas |

**Fire Alarm & Detection System**

| | | |
|---|---|---|
| IS 2189 | : | Selection, Installation and maintenance of automatic fire detection and fire alarm system - Code of Practice |
| IS 11360 | : | Specification for smoke detectors for use in Automatic electric fire alarm system. |

| | | |
|---|---|---|
| IS 2175 | : | Heat sensitive fire detectors for use in automatic fire alarm system. |
| IS 2148 | : | Electrical apparatus for explosive gas atmospheres-flameproof enclosures "d". |
| IS 694 | : | PVC insulated cables for working voltages upto and including 1100 volts – Specification. |
| IS 4237 | : | General requirement for switchgear & control gear. |

**Water Based Fire Protection System.**

| | | |
|---|---|---|
| NPFA 13 | : | Installation of sprinkler systems |
| NFPA 14 | : | Installation of standpipe and hose systems |
| NFPA 15 | : | Water spray fixed system |
| NFPA 25 | : | Fire Pumps & Controllers |
| TAC doc. | : | Recommendation for fire protection of transformers |
| IS 3034: 1993 | : | Fire safety of industrial buildings: Electrical generating & distributing stations - Code of practice. |
| IS 10221 | : | Code of Practice for Coating and Wrapping of underground mild steel pipelines. |
| IS 952 | : | Specification for Fog nozzles for fire brigade use |
| IS-8034 | : | Specification for submersible pump sets. |
| IS 3844 | : | Code of practice for installation & maintenance of internal fire hydrants hose reels on premises. |
| IS 780 | : | Sluice valves for water work purposes |