

HINDUSTAN URVARAK & RASAYAN LIMITED

(A JOINT VENTURE OF CIL, NTPC, IOCL, FCIL & HFCL)

BARAUNI UNIT

Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]



SECTION – I

NOTICE INVITING TENDER

(NIT)

TENDER: REFURBISHMENT, CONSTRUCTION, INSTALLATION AND COMMISSIONING OF 132KV BAY 6 AND 7 AND TRANSMISSION LINE AT NTPC BARAUNI SWITCHYARD FOR HURL BARAUNI.

NIT NO. HURL/BR/CC/23-24/658



HINDUSTAN URVARAK & RASAYAN LIMITED, BARAUNI UNIT
(A JOINT VENTURE OF CIL, NTPC, IOCL, FCIL & HFCL)

- 1.0 HURL (Hindustan Urvarak & Rasayan Limited), Barauni invites on-line bids from eligible Bidders fulfilling the Qualifying Requirements / Pre-Qualification Criteria (PQC) under Two Bid system for aforesaid package.

2.0 **Brief Details**

Published Date	Refer CPP Portal
Bid Document Download / Sale Start Date	Refer CPP Portal
Bid submission Start Date	Refer CPP Portal
Last Date and Time for Bid submission	Refer CPP Portal
Technical Bid Opening Date & Time	Refer CPP Portal
Earnest Money Deposit (EMD) in INR	INR 6,70,823.00
Pre-Bid Conference Date & Time (if any)	Refer CPP Portal
Last Query Date	Refer CPP Portal
Reverse Auction	Shall be intimated later

- 3.0 EMD/Bid Security shall be submitted online/ electronically by RTGS / NEFT in the account of HURL as mentioned below details by the stipulated bid submission closing date and time. The payment details of Bid security shall be submitted along with the bidding documents. Any bid without an acceptable Bid Security (if applicable) shall be treated as non-responsive by the employer and shall not be opened.

Name of the Bank	:	State Bank of India, Overseas Branch, NEW DELHI (17313)
Account Name	:	Hindustan Urvarak & Rasayan Limited
Account No.	:	00000037880422277.
IFSC Code	:	SBIN0004803.

In case of EMD payment through RTGS/NEFT, Bidder must mention "E658" in the transaction description while making the payment (Refer Clause 14 of Section II-ITB).

- 4.0 All UDYAM registered vendors -MSE Category are exempted from submission of tender fee & EMD. UDYAM REGISTRATION CERTIFICATE must be submitted online along with the bidding documents to avail the exemption from furnishing the EMD.
MSE bidders seeking benefits of MSE as specified in the Tender Documents, must submit Attested/Self attested copy of UDYAM certificates (as mentioned in clause 4.0 of ITB) failing which no benefit of MSE shall be extended.
- 5.0 A complete set of Bidding Documents may be downloaded by any interested from the e-tendering Site (<https://eprocure.gov.in/eprocure/app>). Bidder who has downloaded the tender from the Central Public Procurement Portal (CPPP) website <https://eprocure.gov.in/eprocure/app>, shall not tamper/modify the tender document/form including downloaded price bid template in any manner. In case the same is found to be tampered/modified in any manner, bid will be



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completely rejected and EMD would be forfeited and Bidder is liable to be banned from doing business with HURL for a period of two years.

Intending Bidders are advised to visit CPPP website <https://eprocure.gov.in/eprocure/app> regularly till closing date of submission of tender for any corrigendum / addendum/ amendment.

Not more than one tender shall be submitted by one bidder/ bidder(s) having business relationship. Under no circumstance will father and his son(s) or other close relations who have business relationship with one another (i.e., when one or more partner(s)/director(s) are common) be allowed to tender for the same contract as separate competitors. A breach of this condition will render the tenders of both parties liable to rejection.

6.0 Qualifying Requirements / Pre-Qualification Criteria (PQC)

6.1 Commercial Pre- Qualification Criteria

Following is the commercial Pre-Qualification Criteria (PQC) for the subject tender:

Condition 1: Bidder should be either Partnership firm/Sole Proprietor / Limited company.

Documents required (To be Submitted along with technical bid):

- i) For Proprietorship firm - Name of the proprietor to be mentioned. Affidavit of proprietorship in original duly notarized (Latest).
- ii) For partnership firms –Affidavit in originals duly notarized, confirming the current status of the firm along with names of the partners or copy of partnership deed duly notarized (latest) to be submitted
- iii) For limited companies, notarized copy of Certificate of Incorporation, Memorandum & Articles of Association and copy of allotment of Director Identification Number (DIN) number.

Condition 2: The Average Annual financial turnover during the last 3 years financial years should be at least Rs. 1,00,62,346.00

Note-

- (i) In case where audited results for the last financial year as on the date of techno-commercial bid opening are not available, the financial results certified by a practicing Chartered Accountant shall be considered acceptable. In case, Bidder is not able to submit the certificate from practicing Chartered Accountant certifying its financial parameters, the audited results for the three consecutive financial years preceding the last financial year shall be considered for evaluating the financial parameters, a Certificate would be required from the CEO/CFO as per the format enclosed in the bidding documents stating that financial results of the company are under audit as on the date of techno-commercial bid opening and the certificate from a practicing chartered accountant certifying the financial parameters is not available.
- (ii) Other income shall not be considered for arriving at annual turnover.
- (iii) Bidder can either submit Annual turnover for
 - a. FY2020-21, 21-22 & 22-23 with CA certified UDIN.
 - b. FY2019-20, 20-21 & 21-22 with CA certified UDIN.
- (iv) Only ATO with UDIN shall be considered for Evaluation.

Documents required (To be Submitted along with technical bid)



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“Proof of ATO shall be submitted in the form of Audited Balance Sheet along with statement of Profit & Loss Account certified by Chartered Accountant (CA)”. Unique Document Identification Number (UDIN) No. of CA must be clearly indicated in the above statement.
NIT Publication date shall be considered for reckoning Annual Turnover (ATO).

6.2 Technical Pre- Qualification Criteria

Following are the Technical Pre-Qualification Criteria (PQC) for the subject tender:

Condition 1: (6.2.1)

Bidder should have successfully completed **Similar Nature of Work** during last 7 years ending last day of month previous to the one in which applications are invited should be either of the following (value excl. GST & Duties) shall be as follows:

One similar nature of successfully completed work costing not less than the amount equal to Rs. 2,68,32,924.00/- ‘OR’

Two similar nature of successfully completed work each costing not less than the amount equal to Rs. 1,67,70,577.00/- ‘OR’

Three similar nature of successfully completed work each costing not less than the amount equal to Rs. 1,34,16,462.00/-

1. Amount mentioned is exclusive of taxes and duties.
2. The Word “Similar Nature of Work” means “**Bidder Should have experience in supply and commissioning of bay and transmission line (132KV and above) and must have electrical license (of ≥132KV).**”
3. The Total Executed value of the completed order shall be considered for the PQC evaluation.

Note:

1. ~~Similar nature of Work order should contain Unit of measurement in Man-days or Man months for the respective manpower supplied. Any other items of the work order other than man days or man months shall not be considered for evaluation. If the completion certificate value mismatches with the Work order value, then supplier shall submit the documentary evidence for the actual manpower supplied for the same contract under the manpower supplied on Man-days or Man-month basis.~~
2. Cost of completed Service order(s), single/two/three mentioned above, is exclusive of GST& Duties and accordingly executed value of the job excluding GST& Duties shall be considered for evaluation of PQC. The duration in which the job is successfully completed shall be considered for evaluation of PQC which is mentioned in 6.2.1 and shall be evaluated on submission of completion certificate with the Purchase order / agreement copy as supportive documents. The purchase order / agreement should contain complete BoQ / SoR with detailed scope of work.

Documents required (To be Submitted along with technical bid):

1. Copy of Work Order (WO)/PO/rate contract/ agreement with following details:
 - a. Work order/PO/rate contract/ agreement with number, date and value.
 - b. Name of the client and Period of contract.
 - c. Technical specifications, Complete scope of work and contract terms with SoR / BoQ.
2. Completion Certificate issued by client highlighting below:
 - a. Reference Work order/PO/Rate contract with number, date and value
 - b. Name of the client, Period of Contract
 - c. Executed value with quantity under the Work order/PO/Rate contract/ agreement for the particular financial year mentioned.
 - d. Performance of the contract.



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- e. If the executed amount is missing in the completion certificate issued by the client, the bidder shall submit the certificate issued by CA with UDIN for executed amount for the respective order. The details of the respective order should be mentioned in the same.

7.0 Documents for PQC:

- 7.1 BIDDER MUST SUBMIT ANNEXURE-12 of SECTION VI with complete details and all the terms mentioned in the form of note in annexure 12 shall be strictly followed. If the data is not provided in the same HURL reserves the right to reject the bid.
- 7.2 The bidder shall be obligated to furnish an amended copy of the work order in the event that the executed value specified in the completion certificate surpasses the original order value. Failure to comply with this requirement shall grant HURL the right to disqualify the order, and no claims shall be entertained with respect to such occurrences.
- 7.3 The bid Bids will be opened as per date/time as mentioned on the Date specified above or on the date specified on the e-tendering portal. The date of Price-Bid opening will be intimated later on the e-tendering portal.
- 8.0 HURL shall not be responsible for any postal /courier delay for submission of EMD and/or other original documents, if applicable.
- 9.0 HURL reserves the right to reject any or all bids or cancel/withdraw the NIT for the subject package without assigning any reason whatsoever and in such case no bidder/intending bidder shall have any claim arising out of such action.
- 10.0 Bids shall be digitally signed and uploaded by someone legally authorized and competent on behalf of his firm / company i.e., Bidder and relevant documents w.r.t. the same to be uploaded along with the bid by the bidders. **The Power of Attorney of such person needs to be furnished along with bid.** The Power of Attorney to be submitted on Rs. 100/- Non-judicial Stamp paper or on Legal Notary (Duly Notarized).
- 11.0 Bidders are required to submit detailed work orders (similar in nature as defined) along with the work completion certificate endorsed by the client, containing details such as value, quantity, GST, work order reference, actual date of completion, etc. These documents are necessary to fulfill the PQ criteria mentioned and must be submitted with the technical bid. As part of our standard bid evaluation process, HURL reserves the right to request bidders to provide supporting documents for the purpose of verifying the authenticity of bid documents, as well as the information related to quantity, value, or any other relevant details provided in the submitted bid documents. These may include TDS, GSTR forms, Form 26AS, manufacturing license, plant design capacity, production details and other relevant documents. It is important to note that failure to submit the required documents within the stipulated time frame may result in the rejection of the bid.
- 12.0 Wherever executed value is not mentioned in the completion certificate, the copy of certified bills with service tax/GST details as applicable / Separate certificate from respective client (PO issuing company /Engineer In Charge) regarding executed value with GST details, date of completion etc., shall also be accepted towards fulfillment of PQC, if same is submitted along with completion certificate.
- 13.0 Completion certificate submitted by the bidders shall have clarity with respect to whether GST is included/excluded in the supplied value, towards fulfillment of PQC and same shall be ensured by the bidders by submitting proper and relevant documents as required (e.g. separate certificate from respective client regarding GST) along with delivery completion certificate.



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- 14.0 If no clear documents as mentioned above regarding GST / Duties component included/extra/not applicable with respect to the supplied value mentioned in delivery completion certificate is submitted by the bidder & In case GST/duties amount / component is also not specified in the submitted delivery completion certificate, then the amount equivalent to rate of applicable GST/duties as considered by HURL for the subject tender shall be deducted from the value of material supplied mentioned in the completion certificate to arrive at the value of the supplied material without GST/ duties.
- 15.0 Similar ARC and Composite orders submitted for PQC.
- 15.1 Similar ARC (Annual Rate Contract) Jobs that has been successfully completed by the bidder for the originally awarded period shall be considered as completed works even though such ARC is under execution on account of extension. However original term completion should be within the period as indicated in above PQC. Bidder to submit the relevant document along with bid certifying satisfactory completion of the job, executed value of the job and completion date for original period of contract, along with letter of extension of contract, certified by WO issuing company /Engineer In Charge.
- 15.2 If a biannual contract is successfully completed, the order will be considered as two similar types of work. Similarly, if a tri-annual contract is successfully completed, the order will be considered as three similar types of work. Multi-annual contracts will be calculated in the same way, with only the value of one, two, or three years being considered for orders of 1, 2, or 3 similar types of work, subject to the fulfillment of PQC criteria and submission of a work completion certificate. To evaluate this, bidders must submit completion certificates with yearly completion values and required details as stated in PQC criteria 6.2.1. If yearly completion values cannot be provided, bidders must submit a completion certificate with a CA certified copy indicating completion values per year and respective tenure, clearly mentioning UDIN. This is subject to the successful completion of the order within the original awarded period and the requirements outlined in clause 6.2 of Section-1. Bidders must also submit an order amendment copy in case of any extensions, deviations, or other amendments to the order. Failure to submit these documents will result in HURL's right to calculate completion values on a pro-rata basis or using an appropriate calculation method, which will be unquestionable by the bidder.
- ~~15.3 In composite orders where different types and categories of Materials or services are included the evaluation shall be performed considering only the items and its respective values which cover under "Similar nature of work" and accordingly the bidder shall submit the supporting documents. In case of non-submission of the said documents, HURL reserves the right to evaluate as per the data provided by the bidder and the evaluation result shall be unquestionable by the bidder. Also, if the bidder does not submit the said documents may lead to rejection of the bid.~~
- 16.0 The GST part of the bill shall be paid only after confirmation of payment from the successful awarded bidder or after confirmation of the corresponding return filed by the contractor from the GST portal. The GST part of the bill shall be withheld till such confirmation.
- 17.0 In case of sub contract orders, credential as sub-contractor for above PQC shall be considered only when such work orders for sub contract have been issued with approval or written permission of end user/owner/consultant of the owner of the contract from the scope of work of which contractor under the contract has sub contracted a part of or entire work under such work order. In this regard, the bidder has to submit a certificate from the end user/owner/consultant of the owner stating that the main contractor has intimated them about the engagement of sub-contracting OR have been allowed/



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- permitted as a sub-contractor. Based on such Sub contracted portion of the job actually executed by the bidder as subcontractor, PQC evaluation shall be done i.e. In case only part job is subcontracted, similar job & executed value etc for the part job only shall be considered for PQC and not the full job.
- 18.0 Work completion date shall be considered for deciding the period of work experience.
- 19.0 Evaluation Basis:
- 19.1 Bidder should submit the Shortfall documents as requested in the portal. If Bidder do not respond to the shortfall, HURL reserves the right to evaluate without shortfall documents considering the available bid documents and in such case no bidder/intending bidder shall have any claim arising out of such action.
- 19.2 In case tie between two or more bidders at L-1 position, the sole criterion for determining the L1 bidder shall be on the basis of Average Annual Turn Over of the party calculated from ATO of either FY 20-21,21-22 & 22-23 or FY 19-20,20-21,21-22. Bidder having the highest average annual turnover shall be considered as L1 party. If bidder submits ATO for FY 19-20, 20-21, 21-22 and 22-23, then the average ATO of FY 20-21,21-22 & 22-23 and Average ATO of FY 19-20,20-21,21-22 shall be calculated, and Maximum Average ATO shall be taken in to consideration for evaluation. (Ex. Average ATO of FY 19-22 is 1Cr. and Average ATO of FY 20-23 is 1.1Cr. then Average ATO 1.1Cr. of FY 20-23 shall be taken into consideration). NO shortfall shall be raised regarding the ATO if the bidder submits either of any option i.e. FY 20-23 or FY 19-22. MSE and MII preference shall be applicable during the evaluation.
- 20.0 **Evaluation Criteria:** On percentage rate basis.
- 21.0 **Contract Duration / Delivery completion:** Eight (8) Months from the date of issue of PO.
- 22.0 **Mobilization:** Within 7 days from the date of handover of site.
- 23.0 **Effective date of Contract:** From the date of Handover of site / Mobilization.
- 24.0 **Deviation:** 25% of contract value (Within order value).
- 25.0 **Clarification on Tender:** Bidders may raise any queries or seek clarifications within the stipulated time mentioned on the CPP portal. No oral clarifications will be provided, and bidders are advised not to presume any information. Any necessary changes to the tender document resulting from queries will be communicated through a corrigendum. The issuer reserves the right to reject queries received after the deadline and to reject any queries without providing an explanation”
- 26.0 **Performance Bank Guarantee:** Bidder must deposit PBG 10% of the contract value in advance. PBG will be refunded after completion of the contract. In case of PBG payment through RTGS/NEFT, Bidder must mention “P658” in the transaction description while making the payment. The SD remains valid for 3 months beyond the completion date of all contractual obligations, including warranty or guarantee or defect liability period, whichever is later. Upon the completion of the mentioned SD duration, the contractor can apply in writing for the refund of the security deposit along with the necessary supporting documents. It is important to note that HURL reserves the right to forfeit the security deposit (SD) or performance bank guarantee (PBG) if the agency fails to fulfill the contract's terms and conditions, neglects their responsibilities, or does not satisfactorily execute the work.
- 27.0 **Reverse Auction:** Applicable as per HURL’s requirement, with decrement value in multiples of INR 25,000 subject to a maximum cap of 50%.
- 28.0 **Address for Communication.**



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From Technical Department:		
Mr. Anil Chandrakar Chief Manager (Electrical) anilchandrakar@hurl.net.in Ph: 8966905187	Mr. Shashikant Patel Manager (Electrical) shashikant.patel@hurl.net.in Ph: 9099006446	Mr. Yash Bhatia Asst. Manager (Electrical) yashbhatia@hurl.net.in Ph: 8287245833
From Contracts & Materials (C&M) Purchase Department:		
Mr. Ravendran Nagaraju Manager (C&M) nagarajuravendran@hurl.net.in Ph : 07981902800	Mr. Amit Kumar Burman Officer (C&M) amitkrburman@hurl.net.in , Ph. : 06243291724	
From Stores Department:		
Mr. Rakesh Kumar Tiwari Manager (Stores – C&M) rakesh.tiwari@hurl.net.in Ph : +91-9431725439	Mr. Raj Kumar Singh Store Assistant - C&M rajkumar@hurl.net.in Ph : 6355072875	Mr. Chandan Kr. Singh JSA-II – C&M-Stores chandankumarsingh@hurl.net.in 7903336415
Hindustan Urvarak & Rasayan Limited, Barauni Urvarak Nagar, Begusarai, Bihar – 851115		

29.0 Checklist of documents to be submitted:

Sr. No	Documents
1	Techno Commercial Proposal Bid Form. (Enclosed as Annexure-1 of Section VI)
2	Power of Attorney as per requirement mentioned in NIT.
3	Signed, Stamped and Scanned copy of proof for payment of Earnest Money Deposit (EMD) / MSE Certificate with applicable annexure form for exemption.
4	Signed, Stamped and Scanned copy of Certificates like Registration certificate, GST No, PAN No, PF, etc.
5	Signed, Stamped and Scanned copy of Format for Electronics Payment (Enclosed as Annexure-2 to Forms and Procedures i.e., Section VI)
6	Signed, Stamped and Scanned copy of Tender Acceptance Letter (Enclosed as Annexure-3 to Forms and Procedures i.e., Section VI)
7	Documents as required in accordance with Qualifying Requirements / Pre-Qualification Criteria (PQC) i.e., <u>Clause 6</u> of NIT
8	Signed, Stamped and Scanned copy of No deviation Certificate (Enclosed as Annexure-4 to Forms and Procedures i.e., Section VI)
9	Signed, Stamped and Scanned copy of Certificate from CEO/MD/ Legally Authorized Signatory, in the format as enclosed as Annexure-5 to Forms and Procedures i.e., Section VI.
10	Acceptance to Fraud Prevention Policy of HURL, for which the bidder has to submit Signed, Stamped and Scanned copy of Form of Acceptance of Fraud Prevention Policy of HURL. (Enclosed as Annexure-6 to Forms and Procedures i.e., Section VI).
11	Certificate related to Restrictions on procurement from a Bidder of a country which shares a land border with India" i.e. (Enclosed as Annexure-7 to Forms and Procedures i.e., Section VI).
12	Work orders subject to tender for qualification as per Annex – 12 with clearly mentioning Purchase order details relevant to tender based on which PQC can be achieved. Not to be mentioned as "As Attached"/ "mentioned in Bid"/ etc.
13	Declaration of GST (annexure -15) Signed, Stamped and Scanned copy of Declaration of GST (Enclosed as Annexure-15 to Forms and Procedures i.e., Section VI).



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14	Signed, Stamped and Scanned copy of Bid Security Declaration Form (Enclosed as Annexure-13 to Forms and Procedures i.e., Section VI).
15	Signed, Stamped and Scanned copy of GCC, SCC & Scope of Work (i.e. Section-V) of tender document.
16	Any Other Document asked for in the Bidding Document

Note: Failure to Upload Authentic and Correct Documents as mentioned at Sr. No, 1 to 16 above would lead to Rejection of Techno- Commercial Bid. Price Bids shall be opened only of those bidders who are qualified and whose techno-commercial bids are acceptable.

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Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]



SECTION – II

INSTRUCTIONS TO BIDDERS (ITB)



DUSTAN URVARAK & RASAYAN LIMITED, BARAUNI UNIT

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1.0	Introduction	<p>Hindustan Urvarak & Rasayan Limited (HURL) is a joint venture company of Coal India Limited (CIL), NTPC Limited (NTPC) and Indian Oil Corporation Limited (IOCL) as the lead promoters with Fertilizer Corporation of India Limited (FCIL) and Hindustan Fertilizer Corporation Limited (HFCL) as other two partners.</p> <p>HURL, Barauni referred to herein as ‘the Employer’, intends to engage an agency for supply of Goods & related Services or Services as per specifications, Scope of Work as detailed in the Bidding documents.</p>												
2.0	General Information	<p>The prospective Bidders are invited to submit a “Technical & Commercial Bid” and “Price Bid” for the package. Methodology for submission of Bid has been detailed hereunder in this document.</p> <p>Applicability of Reverse Auction may be seen on the CPP website / NIT.</p>												
3.0	Content of Bidding Documents	<p>The items and/or services required, bidding procedures, order/contract terms and technical requirements are prescribed in the bidding documents/Bidding Documents.</p> <p>The bidding documents include the following sections:</p> <table><tr><td>Section-I</td><td>Notice Inviting Tender (NIT)/Tender Enquiry/Invitation for Bid (IFB)</td></tr><tr><td>Section-II</td><td>Instruction to bidder (ITB)</td></tr><tr><td>Section-III</td><td>General Conditions of Contract (GCC)</td></tr><tr><td>Section-IV</td><td>Standard Conditions of Contract (SCC)</td></tr><tr><td>Section-V</td><td>Technical specifications, SOR & Scope of work and other terms & condition.</td></tr><tr><td>Section-VI</td><td>Forms and Procedures</td></tr></table> <p>The Bidder is expected to examine all instructions, forms, terms, conditions, specifications and other information in the bidding documents. Failure to furnish all information required as per the bidding documents or submission of a bid not substantially responsive to the bidding documents in every respect will be at the Bidder’s risk and may result in rejection of its bid.</p>	Section-I	Notice Inviting Tender (NIT)/Tender Enquiry/Invitation for Bid (IFB)	Section-II	Instruction to bidder (ITB)	Section-III	General Conditions of Contract (GCC)	Section-IV	Standard Conditions of Contract (SCC)	Section-V	Technical specifications, SOR & Scope of work and other terms & condition.	Section-VI	Forms and Procedures
Section-I	Notice Inviting Tender (NIT)/Tender Enquiry/Invitation for Bid (IFB)													
Section-II	Instruction to bidder (ITB)													
Section-III	General Conditions of Contract (GCC)													
Section-IV	Standard Conditions of Contract (SCC)													
Section-V	Technical specifications, SOR & Scope of work and other terms & condition.													
Section-VI	Forms and Procedures													
4.0	Benefits To MSEs	<p>Micro and Small Enterprises (MSEs) shall be exempted from paying Earnest Money Deposit.</p> <p>Further, in case of tenders where splitting of quantity is possible, participating MSEs quoting price within price band of L1 + 15 percent shall also be allowed to supply a portion of requirement by bringing</p>												



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		<p>down their price to L1 price in a situation where L1 price is from someone other than a Micro and Small Enterprise and such Micro and Small Enterprise shall be allowed to supply up to 25 percent of total tendered value. In case of more than one such MSE, the supply will be shared proportionately (to tendered quantity).</p> <p>The benefit as above to MSEs shall be available only for Goods/Services produced & provided by MSEs.</p> <p>MSEs seeking exemption and benefits should enclose/upload in e-tender portal an attested/self-certified copy of following registration certificate and BID Security declaration form (Annexure – 13) as a part of his bid, failing which they run the risk of their bid being passed over as ineligible for the benefits applicable to MSEs.</p> <p>i) Ministry of MSME vide Gazette notification no. CG-DL-E-26062020-220191 dated 26.06.2020 had notified certain criteria for classifying the enterprises as Micro, Small and Medium Enterprises and specified, form and procedure for filing the memorandum (Udyam Registration) w.e.f. 01.07.2020 (for complete details of policy refer website of Ministry of MSME i.e. https://msme.gov.in/) Accordingly, Micro and Small Enterprises (MSEs) shall be required to submit Udyam Registration Certificate for availing benefit under Public Procurement Policy for MSEs- 2012.</p> <p>ii) An enterprise registered prior to 30.06.2020 and who is not re-registered with Udyam Registration, shall continue to be valid for a period up to 31.12.2022. Such enterprise shall submit EM Part-II or Udyog Aadhaar Memorandum (UAM) for availing benefits of PPP-2012. (Ref Notification No. CG-DL-E-19012022-232763)</p>
5.0	Cost of Bidding	<p>The Bidder shall bear all costs associated with the preparation and submission of its bid and the Employer will in no case be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.</p>
6.0	Clarification on Bidding Documents	<p>A prospective Bidder requiring any clarification of the Bidding Document shall put the query under Clarification tab of the on-line bid at least three days prior to the clarification end date. EMPLOYER will respond to any request for clarification or modification of the bidding documents that it receives within the time line specified.</p> <p>EMPLOYER will post the Clarifications under Clarification tab at e-tender i.e., CPP website. Bidders can view these clarifications.</p> <p>Bidders are advised to regularly check under Clarification tab regarding posting of clarification, if any.</p> <p>Bidders must check the Clarifications issued before submission of Bid. Should the Employer deem it necessary to amend the Bidding Document as a result of a clarification, it shall do so and upload the</p>



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		amendments in the tender on the e-tender portal.
7.0	Corrigendum/ Amendment to Bidding Documents	<p>At any time prior to the deadline for submission of bids, EMPLOYER may, for any reason, whether at its own initiative, or in response to a clarification requested by a prospective Bidder, amend the bidding documents.</p> <p>The corrigendum's/amendment's will be posted in the tender on the e-tender portal for viewing by the Bidder. The amendments will be binding on Bidders and it will be assumed that the information contained therein will have been taken into account by the Bidder in its bid. Bidders are advised to regularly check the tender regarding posting of Amendments, if any.</p> <p>To give prospective Bidders reasonable time to take the corrigendum/amendment into account in preparing their bid, EMPLOYER may, at its discretion, extend the deadline for the submission of bids.</p>
8.0	Language of Bid	The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Employer, shall be written in English language. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in English. In such case for purposes of interpretation of the Bid such translation shall govern.
9.0	Bid Proposal	<p>Bid shall be complete in all respects and shall be submitted with requisite information and Attachments. It shall be free from any ambiguity.</p> <p>For preparation of Bids, Bidders are expected to go through the complete bidding documents carefully. Material deficiencies in providing the information requested may result in rejection of the Bid.</p>
10.0	Documents Comprising the Bid	<p>The Bid shall comprise of following components:</p> <p>Technical Bid:</p> <p>The following documents are to be furnished by the Bidder as part of the Technical Bid:</p> <ol style="list-style-type: none"> Techno Commercial Proposal Bid Form Power of Attorney as per requirement mentioned in NIT. proof for payment of Earnest Money Deposit (EMD)/ MSE Certificate for exemption with Annexure -13. Certificates like Registration certificate, GST No, PAN No. etc. Format for Electronic Payment Tender Acceptance Letter & Letter of authorization to submit bid. Documents as required in accordance with Eligibility Criteria. Bidder must fill all the details in Annexure-12. No deviation Certificate.



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		<p>i) Certificate from CEO or Managing Director or Legally Authorised Signatory, in the format as enclosed with the Bidding Document certifying that the data and documents furnished by them in respect of Techno-Commercial Evaluation are true and correct including the contents thereof. However, if at any point of time the declarations given in bid are found to be incorrect, HURL shall have the full right to terminate the contract and take any action as per provisions of contract including forfeiture of EMD/Security Deposit.</p> <p>j) Acceptance of Fraud Prevention Policy of HURL,</p> <p>k) Certificate related to Restrictions on procurement from a Bidder of a country which shares a land border with India”.</p> <p>l) Any other document asked for in the Bidding Documents.</p> <p>m) Signed and stamp Copy of GCC, SCC, Technical Specification/scope of work and dully filled all annexures.</p> <p>Price Bid: The Price bid is to be submitted in the BOQ provided in the Tender at https://eprocure.gov.in/eprocure/app. Bidders are advised to fill the BOQ and upload the same on the portal. Bidder should not tamper/modify download price bid template. In case if the same is found to be tampered / modified in any manner, bid will be rejected and EMD would be forfeited and Bidder is liable to be banned from doing business with HURL for a period of 2 years.</p>
11.0	Bid Prices	<p>Bidders shall quote such that the bid price covers all the Supplier's obligations mentioned in or to be reasonably inferred from the bidding documents including all requirements in accordance with the requirements of the Technical Specifications & Scope of Work. Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the bidding documents.</p> <p>Bidders shall give a breakdown of the prices in the manner and detail called for in the Bill of Quantity (BOQ).</p>
12.0	Price Basis	Bidders are required to quote price on the price basis as per Scope of Work / stipulated in the SCC.
13.0	Bid Currencies	All prices to be quoted by the bidders will be in Indian Rupees only, unless otherwise mentioned in the Special Conditions of Contract, on FIRM price basis and to remain valid during the currency of the Contract.
14.0	EARNEST MONEY DEPOSIT (EMD) / BID SECURITY / GUARANTEE:	
		<p>i. The Bidder shall furnish, as part of his bid, Earnest Money Deposit in the amount as stipulated in NIT/IFB/Tender Enquiry, in the form of online payment mode by RTGS / NEFT in the account of HURL details as given in subsequent paragraphs. The receipt of the payment shall be attached as a part of bidding documents. If the</p>



	<p>EMD is paid other than online mode then the EMD shall be submitted in a separate Envelope super-scribed on the top as under: "ORIGINAL EARNEST MONEY DEPOSIT FOR NIT NO.DATED..... FOR (NAME OF PACKAGE) DUE ON (DATE OF BID OPENING) FROM (NAME OF THE BIDDER)."</p> <p>ii. The Earnest Money Deposit (EMD) shall, at Bidders option, be submitted in the following forms:</p> <p>a) electronically by RTGS / NEFT in the account of HURL details as given in subsequent paragraphs or b) in the form of Demand Draft in favour of <i>Hindustan Urvarak & Rasayan Limited</i>, Payable at New Delhi. or c) in the form of an irrevocable bank guarantee.</p> <p>The format of Bid Guarantee (BG) towards EMD shall be in accordance with the form of EMD included in the bidding documents (Annexure 8 of Section VI (Forms and Procedures)). The BG towards EMD shall remain valid for a period of forty-five (45) days beyond the original Bid validity period or beyond any extension in the period of Bid validity subsequently requested from any Scheduled / Commercial Bank recognized by Reserve Bank of India. The Bank Guarantee Verification Checklist duly filled in as per format given in the Bidding Documents is also to be submitted. Bidder shall ensure that all the points of check list are replied in "Yes".</p> <p>iii. Wherever Bids under Joint Venture route are permitted as per Qualifying Requirement in the Bidding Documents, the Earnest Money Deposit of the Joint Venture must be on behalf of all the partners of the Joint Venture.</p> <p>iv. Any bid not accompanied by an acceptable Earnest Money Deposit in accordance with the aforesaid provisions shall be rejected by the Employer as being non-responsive and shall be rejected without being opened.</p> <p>v. The Earnest Money Deposit shall be forfeited in any of the following circumstances without any notice or proof of damage to the Employer:</p> <p>a) If the Bidder withdraws or varies its bid during the period of Bid validity. b) If the Bidder does not accept the Arithmetical correction of its Bid Price c) If the Bidder refuses to withdraw, without any cost to the Employer, any deviation, variation, additional condition or any other mention anywhere in the bid, contrary to the provisions of bidding documents; d) In the case of a successful Bidder, if the Bidder fails, within the time limit, (i) to sign the Contract Agreement (ii) to furnish the required Security Deposit e) If the bidder / his representatives commit any fraud while competing for this contract pursuant to Fraud Prevention Policy of HURL. f) if the Bidder withdraws/ amends, impairs and derogates from the tender.</p>
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	<p>vi. No interest will be payable by the Employer on the said amount covered under Earnest Money Deposit.</p> <p>vii. EMD shall be refunded to all the unsuccessful Bidder within thirty days of acceptance of work order by the successful Bidders and no interest shall be payable thereon. EMD of the bidders whose price are not considered to be opened, shall be released/refunded at the earliest but not later than thirty days beyond the award of the subject work. EMD shall be refunded to successful bidder within (30) thirty days of acceptance of LOA and on submission of PBG by the successful Bidders and no interest shall be payable thereon.</p> <p>viii. RTGS / NEFT details of HURL as under: BANK Details for EMD Payment through NEFT/RTGS: Bank Name—State Bank of India, Overseas Branch, NEW DELHI (17313) IFS CODE: SBIN0004803, Account No: 00000037880422277.</p> <p>Bidders are required to upload Signed, Stamped and Scanned copy of the Certificate as part of Technical Bid, failing to which their bids are liable for rejection.</p> <p>Price Bids shall be opened only of those bidder(s) whose EMD shall be found as per the requirement of the bidding documents.</p> <p>Employer shall not be liable for loss/non-receipt/late receipt of above documents in postal transit.</p> <p>Exemption from submission of EMD: Micro and Small Enterprises (MSEs) bidders are exempted from submission of EMD as per provisions at clause 4.0 above and shall submit Annexure – 13.</p> <p>IMPORTANT: IN CASE OF EMD PAYMENT THROUGH RTGS / NEFT, BIDDER MUST MENTION “EXXX” (As per Section I, clause 3.0) IN TRANSCATION DESCRIPTION WHILE DOING THE PAYMENT. “XXX” to be replaced with the last three digits of the tender reference number. (Example: Tender No.: HURL/BR/CC/22-23/432 then the payment description to be mentioned as “E432”)</p>
15.0	<p>Performance Security / Performance Bank Guarantee (PBG)</p> <p>Within thirty (30) days of the receipt of Purchase Order/Service Order from the Employer, the contractor shall furnish the Contract Performance Security / Guarantee, for the due performance of the Contract for the value as tabulated below with an initial validity up to ninety (90) days beyond the completion date for work plus defect liability period (if any), for due performance of the Contract(s)/Order(s) in any form acceptable to the Employer.</p> <p>PBG amount equivalent to 10% of the work order value shall be applicable.</p> <p>Performance Security / Performance Bank Guarantee (PBG) may be submitted in any of the following forms:</p> <p>a) electronically by RTGS / NEFT in the account of HURL details of which are given in bidding document</p>



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		<p>or</p> <p>b) in the form of an irrevocable bank guarantee in accordance with the form of included in the bidding documents (Annexure 9 of Section VI (Forms and Procedures)) from any Nationalized bank / Scheduled Bank recognised by Reserve Bank of India.</p> <p>Failure of the supplier to submit the above-mentioned Performance Security / Performance Bank Guarantee (PBG) shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.</p> <p>No interest shall be payable by the Employer to the Contractor against the Security Deposit furnished.</p> <p>Performance Security shall be returned after Certification of completion of work and Defect Liability period (if any) by EIC. However, the contractor will have to apply in writing, for refund of the same.</p> <p>IMPORTANT:</p> <p>IN CASE OF PBG PAYMENT THROUGH RTGS / NEFT, BIDDER MUST MENTION “PXXX” IN TRANSCATION DESCRIPTION WHILE DOING THE PAYMENT. “XXX” to be replaced with the last three digits of the tender reference number.</p> <p>(Example: Tender No.: HURL/BR/CC/22-23/432 then the payment description to be mentioned as “P432”)</p>
16.0	Confirmation of BGs through Structured Financial Messaging System (SFMS)/SWIFT	<p>While issuing the physical BGs, the Bidder’s Bank shall also send electronic message through secure SFMS (in case of BGs issued from within India) or SWIFT (in case of BGs issued from outside India) to Employer’s Beneficiary Bank whose details are provided in the Special Purchase Conditions.</p> <p>Bidders are advised to ensure that the message is sent by their Bankers and the Bidders must submit the reference details as part of the bid with the EMD.</p> <p><u>Name of Beneficiary of Bank Guarantee:</u></p> <p>Name of the Bank: State Bank of India</p> <p>Account Name-Hindustan Urvarak & Rasayan Limited</p> <p>Account no-37880422277</p> <p>IFSC code- SBIN0004803.</p> <p>In case of submission of EMD in the form of Bank Guarantee, bidders are requested to provide the Details like Bank Name, Branch address, IFSC code and Branch E-mail Id of BG issuing Branch on EMD submission covering letter</p>
17.0	Ineligibility For Future Tenders	<p>Notwithstanding the provisions regarding forfeiture of Earnest Money Deposit specified above, if a bidder after having been issued the Purchase Order/Contract, either does not accept the Purchase</p>



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		<p>Order/Contract or does not submit an acceptable Performance Security and which results in tender being annulled then such bidder shall be treated ineligible for participation in the present and future tenders issued from HURL - Barauni for a period of 6 months from the date of withdrawal of the purchase order / contract or last communication date of notice issued by HURL, whichever is earlier.</p> <p>If a bidder after opening of tenders where EMD is 'NIL/Not applicable' or exempted for bidders as per policy guidelines, withdraws its offer within the validity period of the offer, then such bidder shall be treated as ineligible for participation in the present and future tenders issued from HURL - Barauni for a period of 6 months from the date of withdrawal of the bid.</p> <p>If a bidder after having been issued the Notification of Award/Purchase Order of a package where EMD is 'NIL/Not applicable' or exempted for bidder as per policy guidelines, either does not accept the Notification of Award/Purchase Order or does not submit an acceptable Performance Security pursuant to ITB Clause titled 'Performance Security', and which result in tender being annulled then such bidder shall be treated ineligible for participation in the present & future tenders issued from HURL - Barauni for a period of 6 months from the date of withdrawal of the purchase order / contract or last communication date of notice issued by HURL, whichever is earlier.</p>
18.0	Period of Validity of Bids (Techno-Commercial Bid and Price Bid)	<p>Bids shall remain valid for a period of 180 days from the closing date prescribed by EMPLOYER for the receipt of bids, unless otherwise specified in Special Conditions of Contract (SCC). A bid valid for a shorter period shall be rejected by EMPLOYER as being non-responsive.</p> <p>In exceptional circumstances, EMPLOYER may solicit the Bidder's consent to an extension of the bid validity period. The request and responses thereto shall be made in writing by post or email or by telefax followed by post confirmation. If a Bidder accepts to extend the period of bid validity, the validity of Earnest Money Deposit shall also be suitably extended. A Bidder may refuse the request without forfeiting its Earnest Money Deposit. A Bidder granting the request will not be required nor permitted to modify its bid.</p>
19.0	Nil Deviation	<p>No deviation, whatsoever, is permitted by EMPLOYER to any provision of Bidding Documents. The Bidders are advised that while making their Bids and quoting prices, all conditions are appropriately taken into consideration. Bidders shall certify their compliance to the complete Bidding Documents as per Certificate at Annexure 4 of Section VI (Forms and Procedures).</p> <p>In case the Products and/or Services offered do not meet the Technical requirements, the bid shall be rejected as Technically non-</p>



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		<p>responsive.</p> <p>Bidders may note that in case the Bidder refuses to withdraw additional conditions/deviations/variations/exception, implicit or explicit, found anywhere in the techno-commercial bid, the bid shall be rejected as Technically non-responsive.</p> <p>Bidders may also note that any deviation/variation in any form in the Price Bid shall result in forfeiture of EMD.</p>
20.0	Format and Signing of Bid	<p>The bid including all documents uploaded in the on-line bid shall be digitally certified by a duly authorised representative of the Bidder to bind him to the contract using Class II or Class-III digital signature (in the name of designated individual with Organisation name). The Digital Signature shall be as per Indian IT Act from the licensed Certifying Authorities (CA) operating under the Root Certifying Authority of India (RCAI) namely Controller of Certifying Authorities (CCA) of India.</p> <p>An authorisation letter/power of attorney indicating that the person signing the bid has the authority to sign the bid is to be submitted in Physical form and copy uploaded as part of the Techno-commercial Bid.</p>
21.0	Submission of Bids	Bid shall be submitted through e-tender mode in the manner specified elsewhere in bidding document. No Manual/ Hard Copy of the Bid shall be acceptable except those asked for in Physical form.
21.1	PHYSICAL BID	
	EMD	<p>The Bidder shall furnish, as part of his bid, a Earnest Money Deposit in the amount as stipulated in NIT/IFB/Tender Enquiry, in a separate envelope (in case paid in modes other than on-line payment) superscribed on the top as under:</p> <p>“ORIGINAL EARNEST MONEY DEPOSIT FOR NIT NO. _____ DATED _____ FOR _____ (NAME OF PACKAGE) _____ DUE ON _____ (DATE OF BID OPENING) FROM _____ (NAME OF THE BIDDER).”</p>
21.2	ON-LINE	<p>Bid along with all the documents should be submitted in the electronic form only through e-Tendering system.</p> <p>Any revision or amendment in bid shall be possible only up to the due date and time of submission of tender.</p>
21.2.1	Techno-Commercial Bid	
(A)	COVER TYPE – FEE	MSEs seeking exemption and benefits should enclose/upload in e-tender portal a attested/self-certified copy of registration certificate as a part of his bid, failing which they run the risk of their bid being



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		passed over as ineligible for the benefits applicable to MSEs.
(B)	COVER TYPE – TECHNICAL	<p>The bidders shall upload documents in compliance to the Bidding Documents.</p> <p>The following documents are to be furnished by the Bidder as part of the Technical Bid:</p> <ul style="list-style-type: none"> a) Techno Commercial Proposal Bid Form (Enclosed as Annexure-1 to Forms and Procedures i.e., Section VI) b) Power of Attorney as per requirement mentioned in NIT. c) Signed, Stamped and Scanned copy of proof for payment of Earnest Money Deposit (EMD)/ MSE Certificate. d) Signed, Stamped and Scanned copy of Certificates like Registration certificate, GST No, PAN No. etc. e) Signed, Stamped and Scanned copy of Format for Electronics Payment (Enclosed as Annexure-2 to Forms and Procedures i.e., Section VI) f) Signed, Stamped and Scanned copy of Tender Acceptance Letter & Letter of authorization to submit bid (Enclosed as Annexure-3 to Forms and Procedures i.e., Section VI) g) Documents as required in accordance with Eligibility Criteria i.e., <u>Clause 6</u> of NIT h) Signed, Stamped and Scanned copy of No deviation Certificate Enclosed as Annexure-4 to Forms and Procedures i.e., Section VI) i) Signed, Stamped and Scanned copy of Certificate from CEO or Managing Director or Legally Authorised Signatory, in the format as enclosed as Annexure-5 to Forms and Procedures i.e., Section VI to Bidding Document shall be furnished certifying that the data and documents furnished by them in respect of Techno-Commercial Evaluation are true and correct including the contents thereof. However, if at any point of time the declarations given in bid are found to be incorrect, HURL shall have the full right to terminate the contract and take any action as per provisions of contract including forfeiture of EMD/Security Deposit. j) Acceptance to Fraud Prevention Policy of HURL, for which the bidder has to submit Signed, Stamped and Scanned copy of Form of Acceptance of Fraud Prevention Policy of HURL.



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		<p>(Enclosed as Annexure-6 to Forms and Procedures i.e., Section VI)</p> <p>k) Certificate related to Restrictions on procurement from a Bidder of a country which shares a land border with India". (Enclosed as Annexure-7 to Forms and Procedures i.e., Section VI)</p> <p>l) Declaration of GST</p> <p>m) Any other document asked for in the Bidding Documents.</p> <p>Note: -</p> <p>Bidders are requested to upload the clearly visible documents only otherwise if not clearly visible then offer shall be liable for rejection without any further communication. The Techno-Commercial Bid should not contain any price content entry. In case, the Techno-Commercial Bid is found to contain any price content, such bid shall be liable for rejection.</p> <p>Checklist of documents to be submitted is enclosed as Annexure-1 to ITB.</p>
21.2.2	Price Bid (COVER TYPE – FINANCE)	<p>The Price bid is to be submitted in the BOQ provided in the Tender at https://eprocure.gov.in/eprocure/app.</p> <p>Bidders are advised to fill the BOQ and upload the same on the portal. Bidder should not tamper/modify download price bid template. In case if the same is found to be tampered / modified in any manner, bid will be rejected and EMD would be forfeited and Bidder is liable to be banned from doing business with HURL for a period of 2 years.</p> <p>Bidders shall necessarily submit the prices on-line in the Bill of Quantity (BOQ) only.</p> <p>For preparation of the "Price Bid", Bidders are expected to take into account the requirements and conditions of the bidding documents. The Price Bid shall be made in the 'BOQ' (excel file) only of Bidding Documents.</p> <p>The rate quoted by the bidder shall be inclusive of all provisions for incidental expenses necessary for proper execution and completion of the work in accordance with the terms & condition of the bidding document.</p> <p>All prices to be quoted by the bidders will be in Indian Rupees only, unless otherwise mentioned in the Special Conditions of Contract, on FIRM price basis and to remain valid during the currency of the Contract.</p>



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Documents to be uploaded in the format stipulated in the tender (online).		
	Note:	In case of Single Stage Two envelope bidding, Price Bid of those bidders whose bids are found to be qualified and technically & commercially responsive shall be opened at a later date under intimation to such bidders.
22.0	Deadline for Submission of Bids	<p>Bids must be submitted online no later than the time and date stated in the Tender Enquiry/NIT/ on line Tender details.</p> <p>The Off-line bid specified in the tender must be submitted to the Employer at the address given in the Special Conditions of Contract before the last date & Time for submission of Bid as specified in the NIT / Tender. Employer shall not be liable for loss/non receipt/late receipt of above documents in postal transit.</p> <p>The on-line Bid must be submitted on the system well before the expiry of time and the schedule specified in the tender notifications, and may note that there is a time lag between the actual placing the bid on the local computer of the bidder and the refreshing of the data on the server.</p> <p>The processing time for data exchange depends on the internet speed of the bidder, therefore bidder should avoid the last-minute hosting of their bid. The bids visible to the Employer will be final for the purpose of acceptance.</p> <p>EMPLOYER may, at its discretion, extend this deadline for submission of bids, in which case all rights and obligations of Employer and Bidders will thereafter be subject to the deadline as extended.</p>
23.0	Modification and Withdrawal of Bids	<p>The Bidder may modify or withdraw its bid after submission prior to the deadline prescribed for bid submission. In case of withdrawal a letter giving the reason for withdrawal is to be uploaded. Once a bid is withdrawn, the bid cannot be re-submitted.</p> <p>No bid may be withdrawn / modified in the interval between the bid submission deadline and the expiration of the bid validity period. Withdrawal/Modification of a bid during this interval may result in the Bidder's forfeiture of its Earnest Money Deposit, pursuant to ITB Clause 14 above.</p>
24.0	Opening of Bids	
	Techno-Commercial Bid Opening	The Employer will first open the Techno-Commercial Bid on the date and at the place specified in the tender enquiry/NIT. In the event of the specified date for the opening of bids being declared a holiday for EMPLOYER, the bids will be opened at the appointed time on the next working day. All important information and other



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		<p>such details as EMPLOYER, at its discretion, may consider appropriate, will be announced at the opening.</p> <p>Technical Bid shall be opened for evaluation.</p> <p>In case of Single Stage Two Envelope bidding, the Price Bid will remain unopened and the date and time for opening of price bids shall be intimated separately on the CPP website by EMPLOYER after completion of evaluation of Techno-Commercial Bids.</p>
	Price Bid Opening	<p>In case of Single Stage Single Envelope bidding, the Price Bid will be opened on the date and time for opening of bids specified after opening of Techno-commercial bids as specified above.</p> <p>In case of Single Stage Two Envelope bidding, after the evaluation process of Techno-Commercial bid is completed, the date and time for opening of price bids shall be intimated separately by Employer. Bidders, whose Techno-Commercial Bid is not substantially responsive, their Technical Bid shall be rejected and their Price bid will also be rejected & shall not be opened and their Earnest Money Deposit shall be returned.</p> <p>Price bids of those Bidders, who have been considered qualified and whose Techno-commercial Bid is found to be responsive, will be opened online in presence of the Bidder's authorised representatives who choose to attend.</p> <p>The participating bidders will be able to view the bid prices of all the bidders after online opening of Price Bids by Employer on the e-tender portal.</p>
25.0	Clarification on Bids	<p>During bid evaluation, EMPLOYER may, at its discretion, ask the Bidder for a clarification of its bid including documentary evidence pertaining to the Purchase Orders/Contracts executed declared in the bid for the purpose of meeting Qualifying Requirement specified in NIT/IFB. The request for clarification and the response shall be in writing, and no change in the price or substance of the bid including substitution of Purchase Orders/Contracts executed in the bid by new/additional Purchase Orders/Contracts executed for conforming to Qualifying Requirement shall be sought, offered or permitted.</p> <p>For this purpose, only 1 chance, shall be given. If the techno-commercial acceptability of bidder is established upon verification of documents including clarifications submitted, the case shall be considered for further processing. If the bidder happens to be defaulter upon verification of the documents or has not uploaded the required document within the mentioned time frame his bid would be analyzed based on the uploaded documents and if found not in order as per requirement, would be outrightly rejected.</p>



<p>26.0</p>	<p>Preliminary Examination Of Techno-Commercial Bids</p>	<p>EMPLOYER will examine the bids to determine whether they are complete, whether required securities have been furnished, whether the documents have been properly signed and whether the bids are generally in order.</p> <p>Prior to the detailed evaluation, the Employer will determine whether the bid is of acceptable quality, is generally complete and is substantially responsive to the bidding document. For purpose of this determination, a substantially responsive bid is one that conforms to all the terms, condition and specifications of the bidding documents without material deviations, objections, conditionality or reservations.</p> <p>A material deviation, objection, conditionality or reservation is</p> <ul style="list-style-type: none"> (i) that effects in any substantial way the scope quality or performance of the contract. (ii) that limits in any substantial way inconsistent with the bidding document the Employers right or the successful bidders obligation under the contract or (iii) whose rectification would unfairly affect the competitive position of other bidders who are presenting substantially responsive bids. <p>Material deficiencies in the bid may render the bid non-responsive and may lead to the rejection of the bid.</p> <p>EMPLOYER's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence. If a bid is not substantially responsive, it will be rejected by EMPLOYER, and may not subsequently be made responsive by the Bidder by correction of the nonconformity.</p>
<p>27.0</p>	<p>Evaluation Of Techno-Commercial Bids</p>	<p>EMPLOYER will carry out a detailed evaluation of the Techno-Commercial bids (of the qualified bidders shortlisted as above) previously determined to be substantially responsive in order to determine whether the technical and commercial aspects are in accordance with the requirements set forth in the bidding documents. In order to reach such a determination, EMPLOYER will examine and compare the technical and commercial aspects of the bids on the basis of the information supplied by the bidders. Bidder may note that no deviation, whatsoever, is permitted by EMPLOYER to any provisions of Bidding Documents.</p> <p>In case the Bidder refuses to withdraw additional conditions/deviations/variations/exception, implicit or explicit, found anywhere in the bid in respect of techno-commercial requirements of the bidding documents, without any financial implication whatsoever to the Employer, the bid shall be rejected as technically non-responsive. Product(s) and/or service(s) not meeting</p>



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		the specified technical requirements & scope work, shall be rejected.
28.0	Preliminary Examination Of Price Bid	<p>The Employer will examine the Price bids to determine whether they are complete, whether any computational errors have been made, and whether the bids are generally in order.</p> <p>In case any additional conditions/deviations/variations/exception, implicit or explicit, is found anywhere in the Price bid, the Earnest Money Deposit shall be forfeited.</p>
29.0	Discrepancies In Bid	<p>In case of discrepancies in the bid, the following will be adopted to correct the discrepancies for Arithmetical for the purpose of evaluation.</p> <p>a) In case of discrepancy between unit price in figures and words, the unit price words will be considered as correct.</p> <p>b) In case of discrepancy between unit price and total price, the unit price will be considered as correct.</p> <p>d) In case of discrepancy between unit price and total price, which is obtained by multiplying the unit price and quantity, or between sub-totals and the total price, the unit or subtotal price shall prevail, and the total price shall be corrected accordingly.</p>
30.0	Evaluation Criteria	<p>The evaluation criteria specified in Special Conditions of Contract (SCC) shall over-ride all other similar related clauses appearing elsewhere in the bidding documents.</p> <p>The evaluation shall be based on the evaluated cost of fulfilling the contract in compliance with all commercial, contractual and technical obligations under this Bidding Document.</p>
31.0	Evaluation Of Bids	<p>a) The Employer shall evaluate each Bid that has been determined, up to this stage of the evaluation, to be substantially responsive.</p> <p>b) To evaluate a Bid, HURL shall only use all the criteria and methodologies defined in this document.</p> <p>c) To evaluate a Bid, HURL shall consider the following:</p> <ul style="list-style-type: none"> • The bid price as quoted as per Bill of Quantity (BOQ) • Price adjustment for correction of discrepancy. • Price adjustment due to Price Preference, pursuant to ITB clause 4.0, if applicable • Price adjustment due to Price Preference due to any other condition specified in Special Purchase Condition; • Price adjustment due to application of the evaluation criteria.
32.0	Contacting The Employer	Subject to ITB clause 25.0 above, no Bidder shall contact the Employer on any matter relating to its bid, from the time of the opening of Bids to the time the contract is awarded.



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		Any effort by a Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in rejection of the Bidder's bid.
33.0	Employer's Right To Accept Any Bid And To Reject Any Or All Bids	The Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids at any time prior to Contract award, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder(s) of the grounds for the Employer's action.
34.0	Award Criteria	<p>Subject to ITB Clause 33, the Employer will award the contract to the successful Bidder whose bid has been determined to be substantially responsive to the Bidding Documents and qualified to perform the contract satisfactorily, as per methodology specified in Special Conditions of Contract (SCC).</p> <p>The Bidder will be required to comply with all requirements of the Bidding Documents without any extra cost to the Employer, failing which his Earnest Money Deposit will be forfeited.</p>
35.0	Construction of Contract	<p>If required, HURL may place separate Orders for supplies and Services.</p> <p>The award of separate Purchase Orders shall not in any way dilute the responsibility of the Supplier for the successful completion of the Facilities as per Contract documents and a breach in one Purchase Order shall be construed as a breach of the other Purchase Order(s) which will confer a right on the Employer to terminate the other Contract(s) also at the risk and cost of the Supplier.</p> <p>The total value of all the orders shall be the Total Package value.</p>
36.0	Notification of Award	Prior to the expiration of the period of bid validity, the Employer will notify the successful Bidder in writing by email or letter or by telefax to be confirmed in writing by letter sent by Speed Post/Registered/courier, that its bid has been accepted. The notification of award (Purchase/Service Order) will constitute the formation of the contract and shall be effective from the date of award or the date as specified in Special Conditions of Contract (SCC).
37.0	Corrupt or Fraudulent Practices	<p>Employer requires that Bidders, Contractors and Suppliers observe the highest standard of ethics during the procurement and execution of the contracts. In pursuance of this policy, Employer:</p> <p>(a) defines, for the purposes of this provision, the terms set forth below as follows:</p> <p>(i) "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract</p>

		<p>execution; and</p> <p>(ii) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition;</p> <p>(b) will reject a bid for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;</p> <p>(c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for or in executing a contract of the Employer.</p>
38.0	Fraud Prevention Policy	<p>The Bidders/ Service Providers/ Vendors/ Consultants etc. shall strictly adhere to the Fraud Prevention Policy of HURL displayed on its website http://www.hurl.net.in and shall not indulge or allow anybody else working in their organization to indulge in fraudulent activities and immediately apprise HURL of the fraud/suspected fraud as soon as it comes to their notice. A certificate to this effect shall be furnished by the bidder along with his bid, in relevant attachment as per format enclosed (Annexure 6 of Section VI (Forms and Procedures)) with the Bidding Document.</p> <p>If in terms of above policy, it is established that the bidder/his representatives have committed any fraud while competing for this contract then the Earnest Money Deposit shall be forfeited.</p>
39.0	Banning Policy	Business dealings may be withheld or banned with the Contractor on account of any Default by the Contractor under Clause 44.
40.0	Indian Agents	<p>In a tender, either the Indian Agent on behalf of the Principal/OEM or Principal/OEM itself can bid but both cannot bid simultaneously for the same item/product.</p> <p>If an agent submits bid on behalf of the Principal/OEM, the same agent shall not submit bid on behalf of another Principal/OEM in the same tender for the item/product.</p>
41.0	Transfer of Bid Documents	<p>a. Transfer of Bidding documents is not permissible.</p> <p>b. Documents purchased / downloaded by the intending bidders cannot be transferred.</p>
42.0	Restrictions on procurement from a Bidder	i. Any Bidder (including its Collaborator/Associate/DJU Partner/JV partner/Consortium Member/Assignee, wherever applicable) from a country which shares a land border with



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	<p>of a country which shares a land border with India</p>	<p>India will be eligible to bid in this tender only if bidder is registered with the Competent Authority.</p> <p>Such registration should be valid for the entire period of bid validity or any extension thereof. However, in case the validity period of registration is less than bid validity period, the Bidder shall be required to submit the extension of the validity period of registration before the opening of price bids, failing which the bid shall be rejected.</p> <p>Further the successful bidder shall not be allowed to sub-contract works to any “Sub-contractor” from a country which shares a land border with India unless such Sub-contractor is registered with the competent Authority as mentioned in SCC. However, the said requirement of registration will not apply to bidders/sub-contractors from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects. Bidders may apprise themselves of the updated lists of such countries available in the website of the Ministry of External Affairs.</p> <p>ii. “Bidder” (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency, branch or office controlled by such person, participating in a procurement process.</p> <p>iii. “Sub-contractor” (including the term ‘Sub-vendor’/Sub-supplier’ in certain contexts) means any person or firm or company, every artificial juridical person not falling in any of the descriptions of Sub-contractors stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.</p> <p>iv. “Bidders from a country which shares a land border with India” / “Sub-contractor from a country which shares a land border with India” mentioned in para above means;</p> <p>a) An entity incorporated, established or registered in such a country; or</p> <p>b) A subsidiary of an entity incorporated, established or registered in such a country; or</p> <p>c) An entity substantially controlled through entities incorporated, established or registered in such a country; or</p> <p>d) An entity whose beneficial owner is situated in such a country; or</p> <p>e) An Indian (or other) agent of such an entity; or</p> <p>f) A natural person who is a citizen of such a country; or</p> <p>g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.</p> <p>v. The beneficial owner for the purpose of clause “iv” above will</p>
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		<p>be as under;</p> <p>a) In case of company of Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.</p> <p>Explanation-</p> <p>i. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company;</p> <p>ii. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholdings or management rights or shareholders agreements or voting agreements;</p> <p>b) In case of a partnership firms, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more judicial person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;</p> <p>c) In case of an unincorporated associations or body of individuals, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;</p> <p>d) Where no natural person is identified under (a) or (b) or (c) above, the beneficial owner is the relevant natural person who holds the position of senior managing officials;</p> <p>e) In case of a trust, the identifications of beneficial owner(s) shall include identification of the author of trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.</p> <p>vi. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.</p> <p>vii. In regard to "Restrictions on procurement from a Bidder of a country which shares a land border with India" bidder has to submit Certificate as per Annexure 7 of Section VI (Forms and Procedures) of the bidding document.</p>
43.0	<p>Preference to Make In India (MII) and granting of purchase preference to local suppliers.</p>	<p>Preference to Make in India and Eligibility for participation/ granting of purchase preference to Class-I local suppliers.</p> <p>Preference shall be given to bidders as per the policy "Public Procurement (Preference to Make in India), Order 2017- Revision order No. 45021/2/2017-BE-II and amendments".</p> <p>Bidder must submit Annexure 14 of section VI for participating in Preference to MII.</p>



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		<p>For order preference, MSE guidelines mentioned above in 4.0 read in conjunction with “Preference to Make in India and granting of purchase preference to local suppliers” mentioned in</p> <p>The bidders may apprise themselves of the relevant provisions of bidding documents in this regard before submission of their bids.</p>
44.0	Termination of contract	<p>If the Contractor:</p> <ul style="list-style-type: none"> (a) at any time makes default in proceeding with the Works with due diligence and continues to do so after a notice of seven (7) days in writing from the Engineer-in-Charge; or (b) commits default in complying with any of the terms and conditions of Contract and does not remedy it or take effective steps to remedy it within seven (7) days after a notice in writing is given to him in that behalf by the Engineer-in-Charge; or (c) fails to complete the Works or items of Work with individual dates of completion, on or before the date(s) of completion, and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer-in-Charge; or (d) shall offer, or give or agree to give to any person in Employer's service or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or having done or forborne to do any act in relation to the obtaining or execution of this or any other Contract for the Employer; or (e) shall enter into a contract with the Employer in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Employer/ Engineer-in-Charge; or (f) shall obtain a Contract with the Employer as a result of ring bidding or other nonbonafide methods of competitive bidding; (g) In case of poor performance, the contract shall be terminated with a notice period of 15 days without any liability to HURL Barauni. IN the event of unsatisfactory performance, Hurl Barauni reserves right to cancel part or whole of the work order / contract /PO and make alternative arrangement at any time during of contract on risk & cost of contractor and / or forfeit security deposit. <p>The Employer may, without prejudice to any other right to remedy which shall have accrued or shall accrue thereafter to the Employer by written notice, cancel the Contract as a whole or only such items of work in default, from the Contract.</p>



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45	Blacklisting	If the contractor is terminated under clause 44 or made ineligible for tendering under clause 17 then HURL reserves the right to black list the bidder for 12 months from the date of notice.
46	Contract Agreement	On successful award of order or issue of Purchase order the bidder shall submit a non- judicial stamp paper of Rs. 1000/- with 03 bond dummy papers along with all other supporting documents as stipulated in the tender document within 30 days of receipt of Letter of Award (LOA) or Purchase order, failing which the tender is liable to be rejected.
	Important Note	The Special Conditions of Contract (SCC) will supersede any other related conditions anywhere else in the Bidding Documents and will prevail for evaluation / finalization of the tender.

Annexure-1 to ITB

Checklist of documents to be submitted:

Sr. No	Documents
1	Techno Commercial Proposal Bid Form. (Enclosed as Annexure-1 to Forms and Procedures i.e., Section VI)
2	Power of Attorney as per requirement mentioned in NIT.
3	Signed, Stamped and Scanned copy of proof for payment of Earnest Money Deposit (EMD) / MSE Certificate with applicable annexure form for exemption.
4	Signed, Stamped and Scanned copy of Certificates like Registration certificate, GST No, PAN No, PF, etc.
5	Signed, Stamped and Scanned copy of Format for Electronics Payment (Enclosed as Annexure-2 to Forms and Procedures i.e., Section VI)
6	Signed, Stamped and Scanned copy of Tender Acceptance Letter (Enclosed as Annexure-3 to Forms and Procedures i.e., Section VI)
7	Documents as required in accordance with Qualifying Requirements / Pre-Qualification Criteria (PQC) i.e., <u>Clause 6</u> of NIT
8	Signed, Stamped and Scanned copy of No deviation Certificate (Enclosed as Annexure-4 to Forms and Procedures i.e., Section VI)
9	Signed, Stamped and Scanned copy of Certificate from CEO/MD/ Legally Authorized Signatory, in the format as enclosed as Annexure-5 to Forms and Procedures i.e., Section VI) to Bidding Document shall be furnished certifying that the data and documents furnished by them in respect of Techno-Commercial Evaluation are true and correct including the contents thereof. However, if at any point of time the declarations given in bid are found to be incorrect, HURL shall have the full right to terminate the contract and take any action as per provisions of contract including forfeiture of EMD/Security Deposit.



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10	Acceptance to Fraud Prevention Policy of HURL, for which the bidder has to submit Signed, Stamped and Scanned copy of Form of Acceptance of Fraud Prevention Policy of HURL. (Enclosed as Annexure-6 to Forms and Procedures i.e., Section VI).
11	Certificate related to Restrictions on procurement from a Bidder of a country which shares a land border with India" i.e. (Enclosed as Annexure-7 to Forms and Procedures i.e., Section VI).
12	Work orders subject to tender for qualification as per Annex – 12 with clearly mentioning Purchase order details relevant to tender based on which PQC can be achieved. Not to be mentioned as "As Attached"/ "mentioned in Bid"/ etc.
13	Declaration of GST (annexure -15) Signed, Stamped and Scanned copy of Declaration of GST (Enclosed as Annexure-15 to Forms and Procedures i.e., Section VI).
14	Signed, Stamped and Scanned copy of Bid Security Declaration Form (Enclosed as Annexure-13 to Forms and Procedures i.e., Section VI).
15	Signed, Stamped and Scanned copy of GCC, SCC & Scope of Work (i.e. Section-V) of tender document.
16	Any Other Document asked for in the Bidding Document

Note: Failure to Upload Authentic and Correct Documents as mentioned at Sr. No, I to 16 above would lead to Rejection of Techno- Commercial Bid. Price Bids shall be opened only of those bidders who are qualified and whose techno-commercial bids are acceptable.



A	Instructions for Online Bid Submission	<p>The bidders are required to submit their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bidsonline on the CPP Portal. More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app.</p> <p>1.0 REGISTRATION</p> <p>1.1 Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: https://eprocure.gov.in/eprocure/app) by clicking on the link “Online bidder Enrollment” on the CPP Portal which is free of charge.</p> <p>1.2 As part of the enrollment process, the bidders will be required to choose a unique username and assign a password for their accounts.</p> <p>1.3 Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.</p> <p>1.4 Upon enrollment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g., Sify / nCode / eMudhra etc.), with their profile.</p> <p>1.5 Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.</p> <p>1.6 Bidder then logs in to the site through the secured login by entering their user ID / password and the password of the DSC / e-Token.</p> <p>2.0 SEARCHING FOR BIDDING DOCUMENTS</p> <p>2.1 There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.</p> <p>2.2 Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the</p>
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		<p>respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e- mail in case there is any corrigendum issued to the Bidding Document.</p> <p>2.3 The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.</p> <p>3.0 <u>PREPARATION OF BIDS</u></p> <p>3.1 Bidder should take into account any corrigendum published on the Bidding Document before submitting their bids.</p> <p>3.2 Please go through the Bidding Document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.</p> <p>3.3 Bidder, in advance, should get ready the documents to be submitted as indicated in the Bidding Document / schedule. Generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.</p> <p>4.0 <u>SUBMISSION OF BIDS:</u></p> <p>4.1 Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. HURL shall NOT be responsible for any delay.</p> <p>4.2 The bidder has to digitally sign and upload the required bid documents one by one as indicated in the Bidding Document.</p> <p>4.3 Bidder has to select the payment option as "offline" to pay the tender fee / EMD as applicable and enter details of the instrument.</p> <p>4.4 Bidder should prepare the EMD as per the instructions specified in the Bidding Document. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the Bidding Documents.</p> <p>4.5 Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BOQ format with the Bidding Document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BOQ file, open it and complete the blue colored (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and</p>
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		<p>submit it online, without changing the filename. If the BOQ file is found to be modified by the bidder, the bid will be rejected.</p> <p>4.6 The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.</p> <p>4.7 All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology.</p> <p>4.8 Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid openers public keys. Overall, the uploaded Bidding Documents become readable only after the tender opening by the authorized bid openers.</p> <p>4.9 The uploaded Bidding Documents become readable only after the tender opening by the authorized bid openers. Upon the successful and timely submission of bids (i.e. after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid withall other relevant details.</p> <p>4.10The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.</p> <p>4.11The Bidder is allowed to re-submit the Bid and related Bid documents before the last date of Bid submission and time. The Bid can be re-submitted as many times as required by the Bidder, within the indicated timelines. The last version of the Bid submitted by the Bidder before the Bid submission date and time will be considered for Bid evaluation.</p> <p>4.12The Bidder is permitted to withdraw his Bid before the last date of Bid submission and time through the CPP Portal. The bidder should provide the supporting reasons for bid withdrawal and attach the supporting letter to the Purchaser.</p> <p>4.13During bid evaluation, EMPLOYER may, at its discretion, ask the Bidder for a clarification of its bid including documentary evidence pertaining to the Purchase Orders/Contracts executed declared in the bid for the purpose of meeting Qualifying Requirement specified in NIT/IFB. The request for clarification and the response shall be in writing, and no</p>
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		<p>change in the price or substance of the bid including substitution of Purchase Orders/Contracts executed in the bid by new/additional Purchase Orders/Contracts executed for conforming to Qualifying Requirement shall be sought, offered or permitted.</p> <p>For this purpose, only 1 chance, shall be given. If the techno-commercial acceptability of bidder is established upon verification of documents including clarifications submitted, the case shall be considered for further processing. If the bidder happens to be defaulter upon verification of the documents or has not uploaded the required document within the mentioned time frame his bid would be analyzed based on the uploaded documents and if found not in order as per requirement, would be outrightly rejected.</p>
B.	Reverse Auction	<p>Procedure in submission of bids by the bidders during Reverse/Forward auction online.</p> <ul style="list-style-type: none"> ➤ Bidders shall login using their login ID & Password and then using DSC. ➤ Click on My Auctions button given in left side of page, to view Action details for which Techno-Commercially qualified. ➤ For participating in Live Auction, <ul style="list-style-type: none"> a) Click on Live Auction Button. b) Click on View button to participate in interested Auction. c) There is List of qualified Lots in which Bidder can participate against selected Auction. d) Click on Hammer Icon to participate in the respective lot. e) On clicking Hammer Icon, system will show Start price, Decremental (or incremental) price and Current price against lot. Current Price is appearing as Blank in case no bidder has offered price. f) Enter your Price in 'My Auction Price' in multiples of decremental (incremental) value up to above (below) Max Seal % value, and then sign it digitally by clicking on Sign Icon and Clickon submit button. g) System will show your Latest Value / Price Quoted and system will also show LeastAmount/ Rate which any Bidder would have quoted. <p>1. Tender Cum Auction is a combination of Tender Followed by Reverse Auction. It is also called as eRA.</p> <p>Subsequently, Reverse Auction will be conducted amongst techno-commercially qualified / approved bidders after Opening of Financial/Price Bids' online.</p> <p>The Reverse Auction will be normally initiated after Opening of Price Bids. There will be no participation fees for Auction. Only such bidders - who have been found techno-commercially qualified as per requirements of the tender will be permitted to participate in the Reverse Auction.</p> <p>After opening of the price (financial) bids, System displays L1</p>



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		<p>price based on either over all basis or item wise/lot basis automatically. Using this system provided price, which would be auction start price procuring entity will create Reverse Auction and publish the same.</p> <p>The Techno-commercially qualified bidders will receive Auction information through SMS & email. The participating bidders get an opportunity to revise their prices (reduce in case of Reverse Auction). It allows bidders multiple opportunities to offer a price.</p> <ol style="list-style-type: none"> 2. The lowest value quoted by the bidder will become the auction start price for auction and the participant bidders have to quote below the auction price. 3. The Bidder would be allowed to bid lower than the opening price of auction in multiples of the decrement value mentioned in <u>para-5</u>. However, bidder can only bid lower than the Lowest Bid. 4. The auction will be done on bid value (to be provided by bidder) which will be derived based upon cost as mentioned in para below. It is inclusive of any taxes, etc. 5. The minimum decrement value will be Rs. 10,000.00 as mentioned in clause VII below. The reduction shall have to be made as per decrement value or in multiple thereof. 6. Bidders shall be able to view the following on their screen along with the necessary fields during Online Reverse Auction: <ol style="list-style-type: none"> a) Current Bid Price in the Auction. b) Start Price. c) Decrement value. <p>At no point of time will any bidder see the names of other bidders, or the prices of bidders other than the lowest bid.</p> 7. In case of Reverse Auction, in order to displace a standing lowest bid and to become "L1", a bidder can offer a minimum bid decrement or in multiples of decremental value up to above Max Seal %. <p>For example: Current price:- Rs. 4,90,000 Decrement value: - Rs. 10000 System Defined Maximum Seal %:- 50, in this case a bidder can quote minimum decrement amount as Rs. 4,90,000-10,000= Rs. 4,80,000 and maximum decrement amount is 490000-245000-10000=235000=240000*.</p> 8. A bidder can continue to revise his bid till the auction ends. However, the Bidder cannot quote/Bid equal to the Leading / Lowest Bid. He must always quote lower than the Leading/Lowest Bid site. 9. The evaluation criteria is based on Price alone in auction. The
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		<p>Bidder who quotes the lowest evaluated Price is determined as the lowest bidder.</p> <ol style="list-style-type: none"> 10. System protects bid and bidder information till auction gets over and displays current L1 price to the bidder. 11. Initial period of reverse auction will be two hours in the slot of 10 minutes. There will be auto extensions of time every time by ten minutes in case of any reduction recorded in the last ten minutes. The reverse auction will come to a close only when there is no further reduction recorded in the last ten minutes slot in any site i.e., after 1 hour 50 minutes. 12. The log details of the entire reverse auction process will be generated by the system once the process of reverse auction is completed. 13. If a bidder does not submit his bid in the Reverse Auction, the price quoted by him in the price bid shall be considered as the final price of that bidder. 14. Since, reverse auction is a sequel to e-tender, the process of finalizing the tender upon completion of reverse auction will be same as the tender process without reverse auction. 15. The bid history shall reflect only the bid value inclusive of taxes. The value will not be same for two bidders even if any bidder makes such an attempt in the bidding. 16. Only the chronologically last price bid submitted by the bidder till the end of the auction shall be considered as the valid price bid of that bidder. Any bid submitted prior to submission of his last bid will not be considered as the valid price bid. 17. Server time shall be the basis of Start time & Closing time for bidding and shall be binding for all. This would be visible to all concerned. 18. All electronic bids submitted during the reverse auction process shall be legally binding on the bidder. The chronologically last bid submitted by the bidder till the end of the auction will be considered as the valid price bid offered by that bidder against that site and acceptance of the same by HURL will form a binding contract between HURL and the bidder for entering into a contract. 19. If the lowest price received during reverse auction is unreasonable or it is unacceptable on ground of being too high compared with estimated price, the HURL management reserves right to seek justification of the price from lowest bidder. If the price is not considered reasonable, HURL may not accept such bid and may go for another tender process. 20. In case of disruption of service at the service provider's end while the RAP is online, due to any technical snag or otherwise attributable to the system failure at the server end, the RAP process will start all over again. In such a situation, the last recorded lowest price of prematurely ended RAP, will be the
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		<p>'Start Bid' price for the restarted RAP. The prices quoted in the prematurely ended RAP will be binding on all the bidders for consideration, if the restarted RAP does not trigger within the stipulated time.</p> <p>21. However, if Reverse Auction does not lead to any bid, HURL shall reserve the right to award the job based on the lowest prices quoted in online commercial bid.</p> <p>22. The successful bidder needs to submit the revised BOQ in line with price quoted by him in reverse auction. The ratio of percentage decrease in cost of each item of BOQ component shall be same as the overall percentage reduction in the bid value originally quoted by successful bidder and final L1 value quoted by successful bidder.</p> <p>23. The detailed Break-up of offered cost, provided by the successful bidder shall be considered and order, if placed, shall be with the same break-up of prices. The successful bidder(s) after reverse auction will be responsible to ensure that the rate as per the breakup of prices provided by him after the reverse auction and total value offered by him in the reverse auction are in same proportion. The successful bidder will not be allowed to increase the rate of any component while submitting the breakup. While giving the break up, the successful bidder will have to consider same rate of taxes as quoted while submitting the commercial bid. In case the successful bidder(s) fail(s) to submit the final BoQ within 3 days or the break up given by bidder does not match with total offered price, the HURL will be at liberty to place order by proportionately reducing the component rates on basis of the breakup of the e-auction bid submitted by the successful bidder along with the initial offer and the same will be binding on the successful bidder.</p>
		<p>Bidders must apprise themselves of the applicable guidelines for submission of and uploading of bids etc. on CPP website.</p>
<p>The GST part of the bill shall be paid only after confirmation of payment from the successful awarded bidder or after confirmation of the corresponding return filed by the contractor from the GST portal. The GST part of the bill shall be withheld till such confirmation.</p>		

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BARAUNI UNIT

Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]



SECTION – III

GENERAL CONDITIONS OF CONTRACTS (GCC)



HINDUSTAN URVARAK & RASAYAN LIMITED, BARAUNI

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The Special Conditions of Contracts (SCC) will supersede any related condition anywhere in the Bidding Documents and will prevail for evaluation / finalization of the tender.

1	Definitions & Terminology	<p>Unless the context otherwise requires, the following terms whenever used in this Contract have the following meanings:</p> <p>“Employer” / “Owner” means the Hindustan Urvarak & Rasayan Limited (HURL), having its registered office Core-4, 9th Floor, Scope Minar, Laxmi Nagar District Centre, Delhi-110092 and its Project office at Barauni, Urvarak Nagar, Begusarai, Bihar – 851115 shall include their legal representatives, successors and permitted assigns.</p> <p>“Contract” means the Contract Agreement entered into between the Owner and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term “the Contract” shall in all such documents be construed accordingly.</p> <p>“Contract Documents” mean the following documents that constitute the Contract between the Employer and the Contractor:</p> <ul style="list-style-type: none"> (i) The Contract Agreement along with its appendices (ii) Letter of Award/Service Purchase Order along with its appendices including agreed variations annexed. (iii) Amendment to Tender/Bidding Documents (iv) Special Conditions of Contract (v) Technical Specifications (vi) General Conditions of Contract (vii) The Bid and Bill of Quantities submitted by the Contractor (viii) Instructions to Bidders <p>“GCC” means the General Conditions of Contract hereof.</p> <p>“SCC” means the Special Conditions of Contract.</p> <p>“Day” means calendar day of the Gregorian Calendar.</p> <p>“Week” means a continuous period of seven (7) calendar days.</p> <p>“Month” means calendar month of the Gregorian Calendar.</p> <p>“Completion” means the fulfilment of the Services by the Contractor in accordance with the terms and conditions set forth in the Contract.</p> <p>“Contractor” shall mean the successful Sole Bidder or Consortium whose bid has been accepted by the OWNER and who has been selected by the OWNER for the award of Works and shall include his heirs, legal representatives, successors and permitted assigns.</p> <p>“Contract Price” means the price to be paid for the performance of the Services, exclusive of GST.</p>
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		Effective Date means the date on which this Contract comes into force pursuant to GCC Clause 15.
		Foreign Currency means any currency other than the currency of the Owner's country.
		"Local Currency" means the currency of the Government of India.
		"Government" means the Government of the Owner's country i.e. INDIA.
		Party means the Owner or the Contractor, as the case may be, and "Parties" means both of them. Third party means any party other than Owner and Contractor.
		Personnel means professionals and support staff provided by the Contractor or by any Sub-Contractor and assigned to perform the Services or any part thereof;
		"Funds" means any funds allocated to the Owner under Company budget, or loan, grants and credits placed at the disposal of the Owner.
		Services means the work to be performed by the Contractor pursuant to this Contract
		Sub-Contractor means any person or entity to whom/which part of the Services is sub-consulted.
		"Engineer" or "Engineer-in-Charge" or "E.I.C." shall mean the officer appointed in writing by the Owner to act as "Coordinator" from time to time on behalf of Owner in all matters pertaining to this Contract. "Engineer-in-Charge" shall be authorized by the Client for supervision, inspection, scrutiny and approval of some or all of the services rendered by the Contractor under the Contract.
2	Order of the precedence of the	"Bill Of Quantity" shall mean the priced and completed Bill of Quantity (BOQ) forming the part of the bid or such Bill of Quantity (BOQ) forming the part of the Contract, as the case may be, with amendments, if any, thereto.
		Throughout these Bidding Documents, the term "Bid" and "Tender" and their derivatives (Bidder/ Tenderer, Bidding / Tendering, Bidding Document/Tender Document, etc.); Bill of Quantity / Schedule of Quantity / Schedule of Quantities/ Bill of Quantities; Owner / Employer / HURL; Bid Security / Earnest Money Deposit; Security Deposit / Performance Security/ Performance Guarantee; Engineer-in-Charge / Engineer, appearing anywhere in the Bidding Documents shall have the same meaning and are synonymous to each other.
		Subject to order of precedence listed below, all documents forming part of the Contract (and all parts thereof) are intended to be correlative,



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	Documents	<p>complementary and mutually explanatory. The Contract shall be read as a whole.</p> <p>The order of precedence of documents shall be as under:</p> <ol style="list-style-type: none"> Contract Agreement and the Appendices Purchase Order/Service Order along with its annexures. Amendment to Bidding Documents Special Conditions of Contract Technical Specifications including Scope of Work General Purchase Conditions The Bid and BOQ submitted by the Supplier Instructions to bidders <p>An amendment issued after issue of Contract shall take precedent over the formal Contract and all other contract documents.</p> <p>In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Documents are listed above.</p> <p>Any error in description, quantity or rate in Bill of Quantity (BOQ) or any omission therefrom shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the Works comprised therein according to drawings and specifications or from any of his obligations under the Contract.</p>
3	Singular and Plural	The singular shall include the plural and the plural the singular, except where the context otherwise requires.
4	Headings	<p>The headings and marginal notes in the General Conditions of Contract are included for ease of reference, and shall neither constitute a part of the Contract nor affect its interpretation.</p> <p>Heading and marginal notes to these General Conditions of Contract shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.</p>
5	Communications and Notices	<p>Communications between Parties (notice, request or consent required or permitted to be given or made by one party to the other) pursuant to the Contract shall be in writing to the Authorized Representatives named in the Contract.</p> <p>A notice shall be effective when delivered or on the notice's effective date, whichever is later.</p> <p>A Party may change its address for notice hereunder by giving the other Party notice of such change to the address.</p>
6	Governing Laws	The Contract shall be governed by and interpreted in accordance with laws in force in India.



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		The Courts of Delhi shall have exclusive jurisdiction in all matters arising under the Contract, unless otherwise stated in the SCC.
7	Governing Language	<p>The Contract shall be written in English. All correspondences and documents relating to the Contract shall be written in English. Supporting documents and printed literature that are part of the Contract may be in another language, as long as such literature is accompanied by a translation of its pertinent passages in English language in which case, for purposes of interpretation, the translation shall govern.</p> <p>The English Translation of the documents shall be carried out by professional translators and the translator shall certify that he is proficient in both languages in order to translate the document and that the translation is complete and accurate. Further, translation shall be authenticated by the Indian Consulate located in the Country where the documents have been issued or the Embassy of that Country in India.</p> <p>The Contractor shall bear all costs of translation to the governing language and all risks of the accuracy of such translation.</p>
8	Assignment	Neither the Owner nor the Contractor shall assign, in whole or in part, their obligations under this Contract; except with prior written approval of the Owner.
9	Authorized Representatives	<p>Engineer-in-Charge</p> <p>If the Engineer-in-Charge is not named in the Contract, then within fourteen (14) days of the Effective Date, the Owner shall appoint and notify the Contractor in writing of the name of the Engineer-in-Charge. The Owner may from time to time appoint some other person as the Engineer-in-Charge in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. The Owner shall take reasonable care to see that no such appointment is made at such a time or in such a manner as to impede the progress of work. The Engineer-in-Charge shall represent and act for the Owner at all times during the currency of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Engineer-in-Charge, except as herein otherwise provided. All notices, instructions, information and other communications given by the Contractor to the Owner under the Contract shall be given to the Engineer-in-Charge, except as herein otherwise provided.</p>
10	Contractor's Authorised Representative	<p>Contractor's Representative</p> <p>If the Contractor's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Owner in writing to approve the person so appointed. If the Owner makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If</p>



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		<p>the Owner objects to the appointment within fourteen (14) days giving the reason therefore, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Clause shall apply thereto.</p> <p>The Contractor's Representative shall represent and act for the Contractor at all times during the currency of the Contract and shall give to the Engineer-in-Charge all the Contractor's notices, instructions, information and all other communications under the Contract.</p> <p>All notices, instructions, information and all other communications given by the Owner or the Engineer-in-Charge to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.</p> <p>The Contractor shall not revoke the appointment of the Contractor's Representative without the Owner's prior written consent, which shall not be unreasonably withheld. If the Owner consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in above GCC Clause.</p> <p>The Contractor's Representative may, subject to the approval of the Owner (which shall not be unreasonably withheld), at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Owner and the Engineer-in-Charge.</p> <p>Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with the above GCC Clause shall be deemed to be an act or exercise by the Contractor's Representative.</p>
11	Relation between the Parties	Nothing contained herein shall be construed as establishing a relation of master and servant or of principal and agent as between the Owner and the Contractor. The Contractor, subject to this Contract, has complete charge of Personnel and Sub-Contractors, if any, performing the Services and shall be fully responsible for the Services performed by them or on their behalf hereunder.
12	Location	The Services shall be performed at such locations as are specified in the Contract and, where the location of a Special task is not so specified, at such locations as the Owner may approve.
13	Taxes & Duties	Contractor, shall bear all tax liabilities, duties, Govt. levies etc. on account of payments made under this Contract. It shall be the responsibility of the Contractor to submit to the concerned Indian authorities the returns and all other concerned documents required for this purpose and to comply in all respects with the requirements of the



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		<p>laws in this regard, in time.</p> <p>It shall be incumbent upon the Contractor to obtain a registration certificate as a dealer under GST Law, and other law(s) relating to levy of tax, duty, cess etc. and necessary evidence to this effect shall be furnished by the Contractor to the Owner.</p> <p>The Contract Price (of both domestic and foreign Contractor) shall also be exclusive of GST applicable on services as per the rates prevailing as on seven (7) days prior to the date of Techno-Commercial bid opening. In case the Contractor is from outside India, who does not have any fixed establishment or permanent address in India, the GST shall be paid to the concerned Tax Authorities in India by the Owner and the same shall be recovered/ deducted from the Contractor.</p> <p>In case of any variation in the rate of GST during the period of Contract, an equitable amount shall be paid/ recovered from the Contractor to fully take into account any such change.</p> <p>If a new tax, duty or levy is imposed or any rates of tax are increased or decreased under statute or law in India after the date seven (7) days prior to date of Techno-Commercial bid opening and the Contractor becomes liable there under to pay and actually pays the said new tax, duty or levy for bonafide use on the work contracted, the same shall be reimbursed/recovered to the Contractor.</p> <p>As regards Income Tax, Surcharge on Income Tax and other Corporate Taxes, including Cess wherever applicable, the Contractor shall be responsible for such payments to the concerned authorities.</p> <p>The Owner shall be entitled to make necessary tax deductions at source as per the prevalent laws. The Contractor shall be required to submit the PAN details before the submission of the first bill/invoice under the Contract.</p> <p>The GST part of the bill shall be paid only after confirmation of payment from the successful awarded bidder or after confirmation of the corresponding return filed by the contractor from the GST portal. The GST part of the bill shall be withheld till such confirmation.</p> <p>In case the Contractor is from outside India, it shall be required to either furnish (i) the certificate from Indian Tax Authority or (ii) Ruling from "the Authority for Advance Ruling (AAR)" determining the applicable rate of Income Tax in India before release of first payment.</p> <p>The Contractor shall himself be informed of all the applicable laws, notifications, rules, circulars and other communications of the State or Central or other authorities with regard to levy of any tax, duty, cess, levy or fee etc, which in any manner may impinge upon him in performance of any obligations/responsibilities under or arising out of the Contract.</p> <p>Further in case of foreign Contractor, certain benefits of Income Tax may be available to him in his country under Double Taxation Avoidance Agreement (DTAA). While quoting for the assignment, the</p>
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		foreign Contractors are required to consider such benefits in their proposal.
14	Effectiveness of Contract	The Contract shall come into force and effect on the date, called the "Effective Date", of the Owner's notice to the Contractor instructing the Contractor to commence carrying out the Services. This notice shall confirm that the effectiveness conditions, if any, as specified in the SCC have been met or as mentioned elsewhere in the tender document.
15	Effective Date	The date the Contract comes into effect shall be as specified in the SCC.
16	Commencement of Services	The Contractor shall commence carrying out the Services not later than the number of days after the Effective Date as specified in the SCC.
17	Modifications or Changes or Amendment	No Modifications or changes or amendment or other variation of the Contract (Purchase Order / Service Purchase) shall be effective unless it is in writing, is dated, expressly refers to the Purchase Order / Service Order, and is signed by a duly authorized representative of Employer and accepted by the Contractor.
18	Contract Price	The Contract price, other than GST, shall remain FIRM throughout the contract period and will be NOT be subject to adjustment for price escalation during the performance of the Contract until unless specified otherwise in the SCC.
19	Severability	If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.
20	Standard of Performance	The Contractor shall perform the Services and carry out its obligations hereunder with all due diligence, efficiency and economy, in accordance with generally accepted professional standards and practices, and shall observe sound management practices, and employ appropriate technology and safe and effective equipment, machinery, materials and methods. The Contractor shall always act, in respect of any matter relating to this Contract or to the Services, as faithful advisers to the Owner, and shall at all times support and safeguard the Owner's legitimate interests in any dealings with Sub Contractors or Third Parties.
21	Conflict of Interests	The Contractor shall hold the Owner's interest's paramount, without any consideration for future work, and strictly avoid conflict with other assignments or their own corporate interests.
22	Confidentiality	The Owner and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the



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		Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Owner to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this clause of GCC.
23	Limitation of Liability	<p>HURL shall in no way be responsible for any liabilities arising out of the Contractor's Contractual obligations with the Contractor's personnel, experts, engineers, sub-Contractors, licensors, collaborators, vendors, or subsidiaries. Similarly, the Contractor shall in no way be responsible for any liabilities arising out of HURL's personnel, sub-Contractors, licensors, collaborators, vendors or subsidiaries.</p> <p>The Contractor and HURL both agree that each shall assume full risk of damages or injury to its own properties, employees and representatives caused by any act or omission to act by their respective employees or representatives, during the performance of this Contract.</p> <p>Except in cases of criminal negligence or willful misconduct,</p> <p>(a) Neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Employer and</p> <p>(b) The aggregate liability of the either party to the other party, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.</p> <p>Notwithstanding anything contained hereinabove, the aggregate liability of the Employer to the Contractor shall not exceed the Total Contract Price, less payments already released to the Contractor, if any.</p>
24	Liability of the Contractor	<p>The Contractor, shall be, liable to and required to indemnify, the Owner as stated under for due performance of the Contract.</p> <p>The Contractor shall indemnify the Owner from and against any and all claims, liabilities, obligations, losses, damages, penalties, actions, judgment, suits, proceedings, demands, costs, expenses and disbursements of whatsoever nature that may be imposed on, incurred by or asserted against the Owner during or in connection with the Services by reason of:</p> <p>(a) infringement or alleged infringement by the Contractor of any patent or other protected right; or</p> <p>(b) plagiarism or alleged plagiarism by the Contractor.</p> <p>The Contractor shall ensure that all goods and services (including without limitation all computer hardware, software and systems) procured by the</p>



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		Contractor out of funds provided or reimbursed by the Owner or used by the Contractor in the carrying out of the Services do not violate or infringe any industrial property or intellectual property right or claim of any third party.
25	Insurance to be taken out by the Contractor	<p>The Contractor</p> <p>(a) shall take out and maintain, and shall cause any Sub-Contractors to take out and maintain, at their (or the Sub-Contractors', as the case may be) own cost, but on terms and conditions approved by the Owner, during the performance of the Contract, the insurance against the risks, and for the coverage as specified in the SCC; and</p> <p>(b) at the Owner's request, shall provide evidence to the Owner showing that such insurance has been taken out and maintained and that the current premiums therefore have been paid.</p>
26	Contractor's Actions Requiring Owner's Prior Approval	<p>The Contractor shall obtain the Owner's prior approval in writing before taking any of the following actions:</p> <p>(a) any subcontract relating to the Services to an extent and, with such specialists and entities as may be approved as</p> <p>(b) any other action that may be specified in the SCC.</p> <p>Notwithstanding any approval as above, the Contractor shall remain fully liable for the performance of Services by the Sub-Contractor and its Personnel and retain full responsibility for the Services.</p>
27	Assistance and Exemptions	<p>The Owner shall use its best efforts to ensure the following:</p> <p>(a) To ensure the accuracy of all information and/or data to be supplied by the Owner to the Contractor necessary for performance of the Contract, except when otherwise expressly stated in the Contract.</p> <p>(b) issue to officials, agents and representatives of the Owner all such instructions as may be necessary or appropriate for the prompt and effective implementation of the Services;</p> <p>(c) provide to the Contractor, Sub-Contractors and Personnel any such other assistance as may be specified in the SCC.</p>
28	Payment Terms	<p>General</p> <p>In consideration of the Services performed by the Contractor under this Contract, the Owner shall make to the Contractor such payments and in such manner as stated below:</p> <p>Payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's bid i.e., INR.</p> <p>No payment made by the Owner herein shall be deemed to constitute acceptance of the Services nor relieve the Contractor of any obligations.</p> <p>Modes of Billing and Payment</p> <p>All the invoices of payment shall be supported by necessary Documents and submitted in quadruplicate for the certification of Engineer-in-Charge for which he will require a maximum time of fifteen (15) days before the same are submitted for processing the payment of amount admitted.</p> <p>The Owner shall pay to the Contractor all the admissible payments within thirty (30) days of certification of the Engineer-in-Charge of the amount payable for the services.</p> <p>Contractor shall furnish the details of Bank Account in the prescribed format along with Bid in order to facilitate the Owner to release</p>



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		<p>Payments electronically through Electronic Fund Transfer system wherever technically feasible. The Contractor shall hold the Owner harmless & Owner shall not be liable for any direct, indirect or consequential loss or damage sustained by the Contractor on account of any error in the information or change in Bank details provided to the Owner in the prescribed form without intimation to Owner duly acknowledged.</p> <p>Vendor Registration:</p> <p>In case of awarding a contract to an unregistered vendor, the vendor registration in HURL vendor data base shall be done based on the GST, MSME, Annexure -2 for bank details etc. submitted along with the bid documents. Once the contractor is registered no changes shall be made in the vendor details till a change request on contractor's letter head is received from the contractor in sign and stamp copy (as per Power of Attorney). The change request should contain the details of the data to be changed, present data, new data and reason for the change along with the supporting documents. For example, in case of change in bank details a change request form on contractor's letter head should contain old bank Account No, New bank account number and reason for change of account number addressing to HURL finance department, along with the cancelled cheque as a supporting document. The Bill payments shall be processed as per the bank details prescribed during the registration or further change request forms if applicable.</p> <p>In case of awarding a contract to HURL registered vendor, the payment shall be processed as per the details shared during initial registration or first awarding or latest bank detail change requests. The same shall apply for other details like MSME or other statutory requirements. The contractor while bidding for the tender should ensure the bid details should match as per the initial vendor registration data or the latest change request.</p> <p>HURL shall not be held responsible for any payment issues if the bank details shared while registration (or the change request if applicable) mismatches with the invoice bank details.</p>
29	Early Warning	<p>If at any time during performance of the Contract, the Contractor or its Sub-Contractors should encounter events, circumstances conditions that may adversely affect the quality of the work, increase the cost of Services or delay the execution of the Services, the Contractor shall promptly notify the Owner in writing of the delay, its likely duration, and its cause. As soon as practicable after receipt of the Contractor's notice, the Owner shall evaluate the situation, and the Contractor shall cooperate with the Owner in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced.</p>
30	Extension of the Intended Completion Date	<p>In the event the Contractor is unable to complete the assignment by the Intended Completion Date it may request the Owner to extend the Intended Completion Date giving reasons. The Owner may extend the Intended Completion Date if the reasons given by the Contractor, including prior review where necessary, are found acceptable. The Owner shall, however, decide by how much to extend the Intended Completion Date.</p>



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31	Good Faith	The Parties undertake to act in good faith with respect to each other's rights under this Contract and to adopt all reasonable measures to ensure the realization of the objectives of this Contract.
32	Liquidated Damage (LD) for Delay	<p>If the Contractor fails to complete the Work on or before the scheduled or extended date of completion, he shall, without prejudice to any other right or remedy of the Employer, arising out of the Contract on account of such delay, be liable for payment of liquidated damages @ ½ percent per week, not as penalty, on the Contract Value of the Work for every week that the progress remains below the required progress or that the Work remains incomplete subject to a maximum of 5% of the Contract Value.</p> <p>In case of amendment in the contract value, the limiting value of the Liquidated damages shall be 5% of the amended Contract Value.</p> <p>The amount of Compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Owner.</p>
33	Change in laws and regulations	If, after the date seven (7) days prior to the last date of Bid submission, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated or changed (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Supplier has thereby been affected in the performance of any of its obligations under the Contract. However, these adjustments would be restricted to items in respect of both direct transactions between the Employer and Supplier.
34	Performance Security	<p>Within thirty (30) days of the receipt of Purchase Order/Service Order from the Employer, the contractor shall furnish the Contract Performance Guarantee (CPG), if applicable, for the due performance of the Contract for ten percent (10%) of the Contract Price with an initial validity up to ninety (90) days beyond the completion date for work plus defect liability period (if any), for due performance of the Contract(s)/Order(s) in any form acceptable to the Employer as mentioned below.</p> <p>CPG may be submitted in any of the following forms:</p> <ol style="list-style-type: none"> a) crossed Demand Draft / Bankers cheque drawn in favour of HURL Payable at New Delhi. b) An irrevocable Bank Guarantee as per the HURL standard format from any Nationalized bank / Scheduled Bank as acceptable to HURL as per list enclosed. <p>Failure of the supplier to submit the above-mentioned Contract Performance Guarantee shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.</p> <p>No interest shall be payable by the Employer to the Contractor against the Security Deposit furnished.</p> <p>Performance Security shall be returned after Certification of completion of work by EIC. However, the contractor will have to apply in writing, for refund of the same.</p>



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		<p>IMPORTANT:</p> <p>In case of PBG payment through RTGS/NEFT, bidder must mention “PXXX-Bidder name” in transaction description while making the payment. “XXX” to be replaced with the last three digits of the tender reference number.</p> <p>(Example: Bidder Name: Pqrst Pvt. Ltd. , Tender No.: HURL/BR/CC/22-23/432 then the payment description to be mentioned as “P432-PqrstPvtLtd”)</p>
35	Force Majeure	<p>Neither CONTRACTOR nor OWNER shall be considered in default in the performance of their obligations under CONTRACT, as long as such performance is prevented or delayed for reasons such as, including but not limited to, whether similar or dissimilar, acts of God, earthquake, tidal wave, tsunami, hurricane, storm, typhoon or cyclone (except monsoon), floods, lightening, land slide, fire or explosions, plague or epidemic, strikes of a whole National category of workers and concerted act of workmen or other industrial disturbances (lasting more than 7 consecutive calendar DAYS), lockouts (lasting more than 7 consecutive calendar DAYS), sabotage, blockade, war, riots, invasion, act of foreign enemies, hostilities (whether war be declared or not), civil war, rebellion, revolution, terrorist acts, insurrection or military or usurped power of confiscation or trade embargoes or destruction or requisition by order of any Government or any Public Authority or for reasons or cause beyond the reasonable control of the affected party provided notice of any such cause is given forthwith and in any event not later than one week (7) DAYS of the happening of the event by the party claiming the benefit of this Clause to the other specifying the matter constituting FORCE MAJEURE explaining to what extent contractual obligations will thereby be prevented or delayed and the further period for which it is estimated that such prevention or delay will continue. CONTRACTOR shall provide justificatory documents countersigned by the local Chamber of Commerce. Notwithstanding the forgoing, FORCE MAJEURE shall not include (a) weather conditions reasonably to be expected for the climate in the geographic area of the SITE including but not limited to the monsoon season, (b) the occurrence of any manpower or material shortages unless such a shortage is itself caused by an event of force majeure, or (c) any delay, default or failure (direct or indirect) in obtaining materials, or in any SUB-CONTRACTOR/VENDOR or worker performing any WORK or any other delay, default or failure (financial or otherwise) attributable to SUB-CONTRACTOR/Vendor/worker, unless such delay, default or failure results from any act, event or condition which would, with respect to such SUBCONTRACTOR/ VENDOR/ worker, constitute an event of force majeure.</p> <p>If the CONTRACTOR suffers delay in the due execution of the contractual obligations due to delays caused by force majeure as defined above, the agreed time of completion of job covered by this CONTRACT or the obligation of the CONTRACTOR shall be extended by a period of time on account of force majeure conditions, provided that on the occurrence of any such contingency, the CONTRACTOR shall within</p>



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		<p>30 days reports to the OWNER in writing, the cause of delay and likely duration of cause of delay with requisite documentary evidence.</p> <p>Should one or both the parties be prevented from fulfilling the contractual obligations by a state of FORCE MAJEURE lasting continuously for a period of 6 weeks, the two parties shall consult each other regarding the future implementation of the CONTRACT. The mere shortage of labour, materials or utilities shall not constitute FORCE MAJEURE unless caused by circumstances which are themselves FORCE MAJEURE.</p> <p>CONTRACTOR and OWNER shall endeavour to prevent, overcome or remove the causes of FORCE MAJEURE.</p> <p>No ground for exemption can be invoked if CONTRACTOR has failed to give timely notice by registered letter and subsequently supported it by documentary evidence.</p> <p>Delay or non-performance by a party hereto caused by the occurrence of any event of FORCE MAJEURE shall not:</p> <p>(a) Constitute a default or breach of the CONTRACT,</p> <p>Or</p> <p>(b) Give rise to any claim for damages or additional cost or expense occasioned thereby, if such delay or non-performance is caused by the occurrence of any event of FORCE MAJEURE. FORCE MAJEURE conditions are not payable under any circumstances.</p> <p>Force Majeure is no one's fault, therefore each party should bear its own cost and a provision to terminate the CONTRACT in case of Force Majeure extending beyond six (06) month is provided. Should OWNER wish the CONTRACTOR to continue further, both parties may sit together and mutually agree on the future course failing which Parties will have the right to terminate. Such termination shall not be considered as Termination for Owner's Convenience. However, outstanding invoices, payment for supplies made and payment to the work already performed will be paid by OWNER on such termination and shall be detailed at the time of CONTRACT finalisation. CONTRACTOR shall have the right to take action to mitigate the impact of the prolonged Force Majeure event in mutual consent with Owner. FORCE MAJEURE shall not apply to any obligation of the OWNER to make payments to the CONTRACTOR under the contract.</p>
36	No Breach of Contract	<p>The failure of a Party to fulfil any of its obligations hereunder shall not be considered to be a breach of, or default under, this Contract insofar as such inability arises from an event of Force Majeure, provided that the Party affected by such an event has taken all reasonable precautions, due care and reasonable alternative measures, all with the objective of carrying out the terms and conditions of this Contract.</p>
37	Measures to be Taken on Force Majeure	<p>A Party affected by an event of Force Majeure shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall take all reasonable measures to minimize the consequences of any event of Force Majeure.</p> <p>A Party affected by an event of Force Majeure shall notify the other Party of such event as soon as possible, and in any case not later than fourteen (14) days following the occurrence of such event, providing evidence of</p>



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		<p>the nature and cause of such event, and shall similarly give written notice of the restoration of normal conditions as soon as possible.</p> <p>Any period within which a Party shall, pursuant to this Contract, complete any action or task, shall be extended for a period equal to the time during which such Party was unable to perform such action as a result of Force Majeure.</p> <p>During the period of their inability to perform the Services as a result of an event of Force Majeure, the Contractor, upon instructions by the Owner, shall either:</p> <p>(a) demobilize, in which case the Contractor shall be reimbursed for additional costs they reasonably and necessarily incurred, and, if required by the Owner, in reactivating the Services; or</p> <p>(b) continue with the Services to the extent possible, in which case the Contractor shall continue to be paid under the terms of this Contract and be reimbursed for additional costs reasonably and necessarily incurred.</p>
38	Suspension	<p>The Contractor shall, on receipt of the order in writing of the Engineer-in-Charge, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary for any of the following reasons:</p> <p>(i) On account of any default on part of the Contractor; or</p> <p>(ii) for proper execution of the Works or part thereof for reasons other than the default on the part of the Contractor; or</p> <p>(iii) for safety of the Works or part thereof, for reasons other than those attributable to the Contractor.</p> <p>The Contractor shall, during such suspension, properly protect and secure the Works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-Charge.</p> <p>The time for completion of the WORKS will be extended for a period equal to the duration of the suspension. The Contractor shall not be eligible for any other compensation whatsoever for such suspension, except as otherwise provided herein under.</p> <p>If such suspension of WORK by OWNER delays or is likely to delay the progress of WORK or the carrying out of WORK under CONTRACT resulting in additional expenses or increased liability to CONTRACTOR, the OWNER shall pay to the CONTRACTOR all reasonable expenses, mutually agreed between OWNER and CONTRACTOR, arising from suspension of the work by an order in writing of the OWNER provided that such suspensions of work is more than a cumulative period of ninety (90) days and provided that such suspension is not due to some fault on the part of the CONTRACTOR or a SUBCONTRACTOR.</p>
39	Termination for Default	<p>The Owner or the Contractor, without prejudice to any other remedy for breach of Contract, by notice of default sent to the other party, may terminate the Contract in whole or in part if the other party causes a fundamental breach of contract. In such an occurrence one party shall give not less than thirty (30) days' written notice of termination to the other party.</p> <p>Fundamental breaches of the Contract shall include but shall not be</p>



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		<p>limited to, the following:</p> <ul style="list-style-type: none"> (a) If the Contractor fails to remedy a failure in the performance of their obligations hereunder, within thirty (30) days of receipt of such notice of suspension or within such further period as the Owner may have subsequently approved in writing; (b) If the Contractor submits to the Owner a statement which has a material effect on the rights, obligations or interests of the Owner and which the Contractor knows to be false; (c) if the Contractor, in the judgement of the Owner has engaged in corrupt or fraudulent practices in competing for or in executing the Contract. <p>For the purpose of this Sub-Clause:</p> <p>"Corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.</p> <p>"Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Owner and includes collusive practice among Contractors (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Owner of the benefits of free and open competition.</p>
40	Termination for Insolvency	<p>The Owner and the Contractor may at any time terminate the Contract by giving notice to the other party if:</p> <ul style="list-style-type: none"> (a) the Owner becomes bankrupt or otherwise insolvent; (b) the Contractor becomes (or, if the Contractor consist of more than one entity, if any of its members becomes) insolvent or bankrupt or enter into any agreements with their creditors for relief of debt or take advantage of any law for the benefit of debtors or go into liquidation or receivership whether compulsory or voluntary; or (c) in such event, termination will be without compensation to any party, provided that such termination will not prejudice or affect any right of action or remedy that has accrued or will accrue thereafter to the other party.
41	Termination for Convenience	<p>The Owner, by notice sent to the Contractor, may in its sole discretion and for any reason whatsoever, terminates the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Owner's convenience, the extent to which performance of the Contractor under the Contract is terminated, and the date upon which such termination becomes effective.</p> <p>In event of termination of Order/Contract, the Employer shall pay to the Supplier/Contractor the Contract Price, properly attributable to the works/supplies executed by the Supplier/Contractor as on the date of termination. However, any sums due to the Employer from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Supplier under this Order/Contract.</p>
42	Termination because of Force Majeure	<p>The Owner and the Contractor may at any time terminate the Contract by giving notice to the other party if, as the result of Force Majeure, the Contractor is unable to perform a material portion of the Services for a period of not less than sixty (60) days.</p>



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43	Cessation of Services	Upon termination of the Contract by notice of either Party to the other pursuant to GCC Clauses 39 to 42, the Contractor shall, immediately upon dispatch or receipt of such notice, take all necessary steps to bring the Services to a close in a prompt and orderly manner and shall make every reasonable effort to keep expenditures for this purpose to a minimum.
44	Payment upon Termination	Upon termination of this Contract pursuant to GCC Clauses to 39 to 42, the Owner shall make the payments to the Contractor for Services satisfactorily performed prior to the effective date of termination.
45	Disputes about Events of Termination	<p>If either Party disputes whether an event specified in GCC Clause 39, 40 or 41 has occurred, such Party may, within forty-five (45) days after receipt of notice of termination from the other Party, refer the matter to arbitration pursuant to GCC Clause 46, and this Contract shall not be terminated on account of such event except in accordance with the terms of any resulting arbitral award.</p> <p>In the case of disagreement between the Parties as to the existence or extent of Force Majeure, the matter shall be settled according to GCC Clause 46.</p>
46	Settlement of Disputes	<p>of Adjudicator</p> <p>Managing Director (MD) of HURL shall be the Appointing Authority for Adjudicator. Adjudicator under the Contract shall be retired judge of Supreme Court/High Court of India.</p> <p>If any dispute of any kind whatsoever shall arise between the Owner and the Contractor in connection with or arising out of the Contract, including without prejudice to the generality of the foregoing, any question regarding its existence, validity or termination, or the execution of the services—whether during the progress of the work or after their completion and whether before or after the termination, abandonment or breach of the Contract—the parties shall seek to resolve any such dispute or difference by mutual consultation. If the parties fail to resolve such a dispute or difference by mutual consultation, then the dispute shall be referred in writing by either party to the Adjudicator, with a copy to the other party.</p> <p>The Adjudicator shall give its decision in writing to both parties within twenty-eight (28) days of a dispute being referred to it. If the Adjudicator has done so, and no notice of intention to commence arbitration has been given by either the Owner or the Contractor within fifty-six (56) days of such reference, the decision shall become final and binding upon the Owner and the Contractor. Any decision that has become final and binding shall be implemented by the parties forthwith.</p> <p>Should the Adjudicator resign or die, or should the Owner and the Contractor agree that the Adjudicator is not fulfilling its functions in accordance with the provisions of the Contract, another Adjudicator shall be jointly appointed by the Owner and the Contractor. Failing agreement between the two within twenty-eight (28) days, the new Adjudicator shall be appointed at the request of either party by the Appointing Authority. Expenses incurred in the process of adjudication including the fees required to be paid to the adjudicator, if any, shall be shared equally between the Owner and the Contractor.</p>



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		<p>Arbitration</p> <p>If either the Owner or the Contractor is dissatisfied with the Adjudicator's decision, or if the Adjudicator fails to give a decision within twenty-eight (28) days of a dispute being referred to it, then either the Owner or the Contractor may, within fifty-six (56) days of such reference, give notice to the other party, with a copy for information to the Adjudicator, of its intention to commence arbitration, as hereinafter provided, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given.</p> <p>Any dispute in respect of which a notice of intention to commence arbitration has been given, in accordance with above clause, shall be finally settled by arbitration. Arbitration may be commenced prior to or after completion of the Services.</p> <p>Any dispute submitted by a party to arbitration shall be heard by an arbitration panel composed of three arbitrators, in accordance with the provisions set forth below.</p> <p>The Owner and the Contractor shall each appoint one arbitrator, and these two arbitrators shall jointly appoint a third arbitrator, who shall chair the arbitration panel. If the two arbitrators do not succeed in appointing a third arbitrator within twenty-eight (28) days after the latter of the two arbitrators has been appointed, the third arbitrator shall, at the request of either party, be appointed by the Appointing Authority as given below:</p> <ol style="list-style-type: none"> a) President, Institution of Engineers in case of an Indian Contractor. b) President, International Chambers of Commerce, Paris in case of a Foreign Contractor. <p>If one party fails to appoint its arbitrator within forty-two (42) days after the other party has named its arbitrator, the party which has named an arbitrator may request the Appointing Authority to appoint the second arbitrator.</p> <p>If for any reason an arbitrator is unable to perform its function, the mandate of the Arbitrator shall terminate in accordance with the provisions of applicable laws as mentioned under the Clause related to Governing Law and a substitute shall be appointed in the same manner as the original arbitrator.</p> <p>Arbitration proceedings shall be conducted</p> <ol style="list-style-type: none"> (i) in accordance with the following rules of procedure: - <ol style="list-style-type: none"> a) In case of a foreign Contractor, the arbitration proceeding shall be conducted in accordance with the United Nations Commission on International Trade Law (UNCITRAL) Arbitration Rules of 1976. b) In case of an Indian Contractor, adjudication/Arbitration proceedings shall be conducted in accordance with Indian Arbitration and Conciliation Act 1996. In case the Indian Contractor is an Indian Public Sector Enterprise/Government Department (but not a State Govt. Undertaking or Joint Sector Undertaking which is not a subsidiary of Central Govt. Undertaking), the dispute arising between the Owner and the Contractor shall be referred for resolution to a Permanent
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		<p>Arbitration Machinery (PAM) of the Department of Public Enterprises, Government of India.</p> <p>c) In case of a foreign collaborator/associate of the Contractor, the arbitration proceedings shall be conducted in accordance with the United Nation Commission on International Trade Law (UNCITRAL) Arbitration Rules of 1976.</p> <p>(ii) in New Delhi, India (Place for Arbitration)</p> <p>(iii) in the language in which this Contract has been executed.</p> <p>The decision of a majority of the arbitrators (or of the third arbitrator chairing the arbitration, if there is no such majority) shall be final and binding and shall be enforceable in any court of competent jurisdiction as decree of the court. The parties thereby waive any objections to or claims of immunity from such enforcement.</p>
47	Fraud Prevention Policy	<p>The Supplier along with their associate / collaborator / subcontractors / sub-vendors / consultants / service providers shall strictly adhere to the Fraud Prevention policy of the Employer displayed on its tender website http://www.hurl.net.in.</p> <p>The Supplier along with their associate / collaborator / subcontractors / sub-vendors / consultants / service providers shall observe the highest standard of ethics and shall not indulge or allow anybody else working in their organization to indulge in fraudulent activities during execution of the Contract (Purchase Order/Service Order).</p> <p>The Supplier shall immediately apprise the Employer about any fraud or suspected fraud as soon as it comes to their notice.</p>
48	Risk purchase	<p>In the event Contractor fails to execute the services in scheduled completion period, HURL reserves the right to get the job executed from any other source at the Contractors risk and cost and the difference in cost shall be borne by the Contractor.</p> <p>Further, HURL shall retain the right of forfeiture of Performance Security and or any other action as deemed fit.</p>
49	Price Basis	<ol style="list-style-type: none"> 1. The services shall be carried out at HURL Barauni as required by EIC. 2. The contractor shall ensure that the submitted quotation shall be in line with the latest statutory compliance. 3. To & Fro, Fooding, Boarding, Lodging and Local conveyance is in the scope of contractor.

IMPORTANT NOTE	<p>The Special Conditions of Contract will supersede any other related conditions anywhere in the tender documents and will prevail for evaluation / finalization of the tender.</p>
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BARAUNI UNIT

Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]



SECTION – IV

SPECIAL CONDITIONS OF CONTRACTS (SCC)

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Wherever there is a conflict, the provisions herein shall prevail over those in the GCC. The corresponding clause number of the GCC is indicated.

SCC Clause	Reference Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract or additional clauses
1	Qualifying Requirements / Pre-Qualification Criteria (PQC)	As per clause 6.0 of Section 1 i.e., NIT (Notice Inviting Tender).
2	Price Bid/ BOQ	<p>Schedule of price bid / BOQ in the form of BOQ658.xls is provided along with this tender document at https://eprocure.gov.in/eprocure/app.</p> <p>Bidders are advised to upload the same in the commercial bid. Bidder shall not tamper/modify download price bid template in any manner. In case if the same is found to be tampered / modified in any manner, tender will be completely rejected and EMD would be forfeited and tenderer is liable to be banned from doing business with HURL.</p> <p>The quoted rate/amount shall be inclusive of taxes duties, levies including any other incidental charges applicable for the complete scope/supply excluding GST.</p> <p>The GST shall be paid extra as per the provisions of Clause 6 (i.e., Taxes and Duties) of SCC.</p> <p>Note: Quantity mentioned in the SOR is non-splitable under the tender.</p>
3	<u>Bid Evaluation</u>	<p><u>Pre-Qualification Evaluation</u></p> <p>HURL, by the examination of Techno-Commercial Bid, will determine to its satisfaction whether the participating bidders are qualified to satisfactorily perform the contract in terms of Pre- Qualification Criteria stipulated in clause 1 of SCC.</p> <p>An affirmative determination of meeting the Pre- Qualification Criteria will be a prerequisite for further evaluation of Techno-Commercial bid. A negative determination will result in rejection of the Bidder's Techno-Commercial Bid in which event HURL will not open the Price Bid of the concerned bidder and his EMD shall be returned.</p> <p><u>Technical Bid Evaluation</u></p> <p>Bids shall be scrutinized on Techno-Commercial parameters based on the documents as mentioned in Annexures to ITB. Bidders are required to submit fully compliant bid. The bidders are required to furnish no deviation certificate in conformity to same. The bidder who has not submitted / furnished such certificate, their price bid shall not be opened. The PRICE BID shall be opened only of those bidders whose bid would have been considered techno-commercially accepted. Conditional bid will not be accepted.</p> <p><u>Price Bid Evaluation</u></p>

		<p>Price bid(s) of the bidder(s) shall be evaluated on the basis of Percentage basis of bidder's quote for all the items as quoted by bidder in SOR excluding GST amount.</p> <p>The lowest evaluated price of the technically qualified bidder shall be considered for initiating of Reverse Auction (RA) Process and the Lowest Received Price of the bidder after the completion of Reverse auction shall be considered for award.</p> <p>Reverse Auction (RA) Process shall be conducted on the total quantity of BOQ.</p> <p>The financial comparison for selection of Lowest (L-1) Bidder after reverse auction shall be done based on the total derived price of all the items mentioned in BOQ/SOR. The aggregate amount will be worked out as total derived price of all items of BOQ, shall be considered for evaluation and award.</p> <p>The successful bidder needs to submit the revised BoQ in line with price quoted by him in reverse auction. The ratio of percentage decrease in cost of each component shall be same as the overall percentage reduction in the bid value originally quoted by successful bidder and final L1 value quoted by successful bidder after reverse auction.</p> <p>The detailed Break-up of offered cost, provided by the successful bidder shall be considered and order, if placed, shall be with the same break-up of prices. The successful bidder after reverse auction will be responsible to ensure that the rate as per the breakup of prices provided by him after the reverse auction and total value offered by him in the reverse auction are in same proportion. The successful bidder will not be allowed to increase the rate of any component while submitting the breakup. While giving the break up, the successful bidder will have to consider same rate of taxes as quoted while submitting the commercial bid. In case the successful bidder(s) fail(s) to submit the final BoQ within 3 days or the break up given by bidder does not match with total offered price, the HURL will be at liberty to place order by proportionately reducing the component rates on basis of the breakup of the e-auction bid submitted by the successful bidder along with the initial offer and the same will be binding on the successful bidder.</p> <p>However, if Reverse Auction does not lead to any bid, HURL shall reserve the right to award the job based on the lowest prices quoted in online commercial bid.</p> <p>HURL Reserves the right to cancel the reverse auction as per the requirement. The management reserves the right to accept/ reject any or all tenders at the time prior to award of contract without assigning any reasons whatsoever.</p>
4	Award Criteria	<p>HURL reserves the right to negotiate price with L1 bidder.</p> <p>HURL will award the Contract to the successful Bidder whose Technical and Commercial bid has been determined to be substantially responsive and Price Bid to be the lowest evaluated Bid.</p> <p>HURL reserves the right to negotiate with the L1 Bidder after the opening of the price bid. The L1 bidder must respond to the communication within stipulated time. Failure to respond will be considered a deliberate delay in the tendering process or a lack of interest in the tender. As a result, the L1 bid will be deemed invalid, potentially resulting in your exclusion from future tender opportunities.</p>

		If intentional non-responsiveness is determined, HURL reserves the right to blacklist the bidder.
5	Contract Price	<p>Price to be quoted shall be firm and subject to no escalation whatsoever during the contractual completion period including extended period, if any, except for any statutory variations i.e. change in the rate of tax & duty and/or inclusion of any new tax & duty. Bid with variable price will not be accepted.</p> <ol style="list-style-type: none"> 1. Material shall be delivered at HURL, Barauni plant site. 2. FOR – HURL Barauni 3. Packing, Forwarding, Freight & insurance is in the scope of supplier. 4. For installation / ARC / AMC services, the services shall be carried out at HURL Barauni plant site as required by EIC. To & Fro, Fooding, Boarding, Lodging and Local conveyance is in the scope of contractor.
6	Taxes and Duties	<p>The Bidder shall include all the taxes, duties/ levies etc (except GST) in their quoted rates / prices. GST charges shall be paid extra at actual by the owner limited to the GST charges indicated by the bidder in the summary of SOR. Statutory variation in taxes and duties including imposition of any new tax & duty, within the scheduled Completion period, as per Contract/Work order, shall be paid by contractor.</p> <p>The Contractor has to submit / furnish all necessary documents / information to enable claim the input credit benefit, if any, under GST rules.</p> <p>The contractor shall indemnify the Company against levy of any taxes/charges etc., imposed by the Govt. or any authority which are in existence at the time of submission of tender and also future statutory levies and the Contractor failed to deposit the same. The Company shall have the right to recover the total amount of tax so assessed including litigation expenses from contractor's bills / security deposit.</p> <p>GST payment applicable at the time of awarding the contract shall be subject to any change in GST law in future.</p> <p>The GST part of the bill shall be paid only after confirmation of payment from the successful awarded bidder or after confirmation of the corresponding return filed by the contractor from the GST portal. The GST part of the bill shall be withheld till such confirmation.</p> <p>GST Registration Number of HURL Barauni is 10AADCH9368N1Z7</p> <p>Please mention GST Number & PO number in Invoice / Challan wherever applicable and HURL shall not be liable for any delay in payment if the same is not mentioned.</p>
7	Payment Terms & Documents required for Payment	<ol style="list-style-type: none"> 1. The Owner shall pay to the Contractor all the admissible payments on monthly basis for actual operated quantity within thirty (30) days of certification of the Engineer-in-Charge of the amount payable for the services. 2. Bidder must deposit PBG 10% of the contract value in advance. PBG will be refunded after completion of the contract. In case of PBG payment through RTGS/NEFT, Bidder must mention “P658” in the transaction description while making the payment. The SD remains valid for 3 months beyond the completion date of all contractual obligations, including warranty or guarantee or defect liability period, whichever is later. Upon the completion of the mentioned SD duration, the contractor can apply in writing for the refund of the security deposit along with the necessary

		<p>supporting documents. It is important to note that HURL reserves the right to forfeit the security deposit (SD) or performance bank guarantee (PBG) if the agency fails to fulfill the contract's terms and conditions, neglects their responsibilities, or does not satisfactorily execute the work.</p> <p>3. Tax deduction at source Income tax, as applicable as per income tax act, shall be deducted at source from the Contractor's bills and a certificate towards this deduction shall be issued to the Contractor.</p> <p>4. Price Basis: Shall be firm till the completion of the contract for works.</p> <p>5. For manpower contract any increasing or decreasing in statutory minimum wage as notified by the Government with respect to minimum wage shall be reimbursed to or deducted from the contractors bills from date of said increase or decrease effected by the Govt. in respect of each worker engaged by the contractor during pendency of the contractor. Also, consequential effect of increase/decrease, minimum wages toward PF (Limited to Employer's contribution only), bonus, ESI shall also be reimbursed to the contractor or deducted from the contractor's bill as case may be subject to the production of the relevant proof. Mode of reimbursement of such differential wage will be as follows: "All difference in wage shall be reimbursed on actual labour deployment basis after completion of 12 months of contract period or final bill whichever is earlier on the written request of the contract with requisite statement and proof of documents for claim". However, the owner shall not reimburse any increase in amount thereof towards income tax and sale/trade at, any other applicable taxes etc. these liabilities are to be borne by the contractor only.</p> <p>6. There shall be no service charges / profit component payable to the contractor on account of differential amount reimbursed to the contractor towards increase in the minimum wages.</p> <p>7. TDS shall be deducted as per the statutory norms.</p> <p>8. HURL's total sales turnover has exceeded Rs. 10 crores during the FY 2022-23. Consequently, we now qualify as a buyer under section 194Q of the Income Tax Act, and it is mandatory for us to deduct tax at a rate of 0.1% on the purchase of any goods with a value exceeding fifty lacs in the financial year or the aggregate of such value. All suppliers or contractors to discontinue the collection of tax (TCS) on all sales invoices. HURL will deduct tax at a rate of 0.1% TDS under section 194Q of the Income Tax Act.</p> <p>9. LD : If the Contractor fails to mobilize the services within the stipulated time or fails to deliver the scheduled material by the scheduled delivery date, the Contractor shall be liable for liquidated damages. This liability shall not prejudice any other rights or remedies of the Employer arising from the Contract due to such delay, be liable for payment of liquidated damages @ ½ percent per week, not as penalty, on the Contract Value of the Work for every week subject to a maximum of 5% of the Contract Value. In case of amendment in the contract value, the limiting value of the Liquidated damages shall be 5% of the amended Contract Value. The amount of Compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Owner.</p>
8	Defect Liability Period	12 months form the actual completion of the work.

9	Governing Laws GCC CLAUSE 6	As per GCC.
10	Effective Date GCC CLAUSE 14 & 15	As per Section V i.e., Scope of Work, Technical Specifications and Other Terms and Conditions.
11	Commencement of supply GCC CLAUSE 16	As per Section V i.e., Scope of Work, Technical Specifications and Other Terms and Conditions.
12	Insurance to be taken out by the Contractor GCC CLAUSE 25	<p>The contractor must provide insurance coverage for all their workers for death or bodily injury or occupational disease that may arise out of or in the course of employment, in accordance with statutory requirements and wherever applicable. The necessary insurance(s) to cover the risk of accidents resulting in the loss of life, material, etc., to the crew or third party, must also be arranged by the contractor at their cost. All contractor equipment is solely at the contractor's risk.</p> <p>The contractor must insure all their personnel employed for the execution of the work against any personal injury that may result from the execution of the work, and provide satisfactory evidence to the owner/consultant that such insurance is in force, wherever applicable.</p> <p>The contractor must take out a workers' compensation policy and an ESIC policy for the deputed manpower, and the charges are deemed to be included in the quoted price wherever applicable or as per statutory compliance. Any additional insurance required during the execution of the work is the responsibility of the contractor.</p> <p>The contractor must arrange transit insurance coverage for all risks associated with the transportation of materials from the source to the destination. Any additional insurance required during the execution of the work, such as for the supply of materials, is also the responsibility of the contractor, and the insurance charges are deemed to be included in the quoted price.</p> <p>When installation services are needed, the contractor must obtain all necessary insurance for their manpower/field service engineers and comply with all statutory requirements. HURL will not be liable for the contractor's insurance. The contractor must properly cover and protect any part of the work that may be susceptible to damage due to exposure to weather, and take every reasonable precaution against accidents or injury to the work from any cause. All contractor equipment will be at the sole risk of the contractor. Insurance coverage for the manpower entering the plant premises for the delivery of the item is the responsibility of the contractor.</p>
13	Contractor's Actions Requiring Owner's Prior Approval	As per GCC

	GCC CLAUSE 26	
14	Contract Period	Eight (8) Months from the date of issue of PO.
15	Signing of Contract Agreement	<p>The successful tenderer / bidder shall be required to execute a contract agreement on non-judicial stamp paper of Rs.1000 in the prescribed proforma (enclosed as Annexure-11 to Section VI i.e., Forms and Procedures) with the Company within 30 (thirty) days of the issue of the work order of the same for carrying out the work according to the general and special conditions of contract specified in the Tender Document.</p> <p>Cost of non-judicial stamp paper shall be borne by successful bidder. The contract shall be presumed to be effective from the effective date contract. The Tender Document, Letter of Acceptance and other correspondence between the Company and the tenderers shall form part of the contract.</p> <p>Failure of the successful tenderer / bidder to execute the above-mentioned Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.</p>
16	NOTICE OF DEFAULT	<p>In the event of any default by either party hereto, in respect of any of its obligations and responsibilities under the Contract, the party not in default shall give notice in writing to the other party calling upon it to rectify such default. Should the party in default does not rectify such default within a period of thirty (30) days of the receipt thereof within the said period, the other party shall be entitled to treat it as a breach of Contract and notice to that effect shall be given forth with.</p>
17		If a tenderer resorts to any frivolous, malicious or baseless complaints/allegations with an intent to hamper or delay the tendering process or resorts to canvassing / rigging/influencing the tendering process, HURL reserves the right to debar such tenderer from participation in the future tenders up to a period of 2 years.
18		Bidders must before submission of their Bids, acquaint themselves with all applicable regulatory and other legal requirements pertaining to insurance and health, safety and environment requirement in India and rules related to work permit and visa requirements in India or in any way or manner affecting the performance of Scope of Work, the Contractor and the Plant operation and performance including social security, safety, pollution control, permits, licenses, and the other statutory requirements and regulations. The submission of a Bid by the Bidder will be construed as evidence that such an examination was made and the Bidder shall not raise at any time later any claims/disputes against the Owner and the Owner shall not be liable for the same in any manner whatsoever.
19		For proper execution of work sufficient numbers of tools & tackles are to be provided by the agency at their own cost, nothing shall be paid extra for this. The contractor shall abide by all statutory rules and regulations of Local authority, State and Central Govt. as the case may be with regard to statutory benefits and non-statutory benefits prevailing at HURL-Barauni as applicable, at his own cost and hence the agency has to quote their rate accordingly by taking care of all these. HURL reserve the right to terminate the contract at any time during the contract period in case performance is not found satisfactory and work not carried as per instruction of Officer-in-charge.

20	The Bid Specific conditions of contract mentioned In Section V shall supplement the Special Conditions of Contract (SCC) wherever applicable.
21	<p>General Note : Wherever applicable,</p> <ol style="list-style-type: none"> 1. The bidder must ensure that the transporter carries the necessary documents, including the driving license, RC book, PUC certificate, and insurance copy, during the delivery of materials along with the invoice. 2. The bidder must mention the Purchase order number on the consignment / Product package with the name of the concerned technical department and stores department mentioned in the Section -1 of tender / NIT / RFQ. 3. The bidder must share the dispatch details in advance with HURL C&M - Purchase, C&M- Stores and the indenting department as per the communication details mentioned in section 1 of the tender documents. 4. The bidder must mention the HURL Purchase Order number and material code in the invoice/Delivery challan against each line item. 5. The bidder must provide the transporter with the contact details of HURL store personnel / EIC for ease of communication as mentioned in the Section -1 of tender / NIT / RFQ. 6. Wherever applicable, the bidder must submit Security deposit and Contract agreement copy within stipulated time as mentioned in tender documents. The formats of the same are mentioned in the FORMS or in the Last section of the tender document as annexures. <p>Any delays caused by non-compliance with the above instructions may result in delayed payment, and HURL shall not be responsible for such instances.</p> <p># Note : HURL's total sales turnover has exceeded Rs. 10 crores during the FY 2022-23. Consequently, we now qualify as a buyer under section 194Q of the Income Tax Act, and it is mandatory for us to deduct tax at a rate of 0.1% on the purchase of any goods with a value exceeding fifty lacs in the financial year or the aggregate of such value. Therefore, we kindly request all our suppliers or contractors to discontinue the collection of tax (TCS) on all sales invoices. HURL will deduct tax at a rate of 0.1% TDS under section 194Q of the Income Tax Act.</p>
22	<p>MSE Seeking Exemption:</p> <ol style="list-style-type: none"> 1. MSEs seeking exemption and benefits should enclose an attested/self-certified copy of registration certificate i.e Udyog Aadhaar Memorandum, certificate of incorporation, manufacturing license with production details (production capacity etc.) as a part of his bid, giving details such as stores/services, validity (if applicable) etc. failing which they run the risk of their bid being passed over as ineligible for the benefits applicable to MSEs. 2. The benefit as above to MSEs shall be available only for Goods/Services produced & provided by MSEs. 3. Further, in case of tenders where splitting of quantity is possible, participating MSEs quoting price within price band of L1 + 15 percent shall also be allowed to supply a portion of requirement by bringing down their price to L1 price in a situation where L1 price is from someone other than a Micro and Small Enterprise and such Micro and Small Enterprise shall be allowed to supply up to 25 percent of total tendered value. In case of more than one such MSE, the supply will be shared proportionately (to tendered quantity). However, in case of tenders where splitting of quantity is not possible, participating MSEs quoting price within price band of L1 + 15 percent shall be allowed to execute the package by bringing down their price to L1 price in a situation where L1 price is from someone other than a Micro and Small Enterprise. The award shall be made as follows: <ol style="list-style-type: none"> 3.1. Award shall be given to L1 bidder if L1 bidder is an MSE. 3.2. In case L1 bidder is not an MSE, then all the MSE vendor(s) who have quoted within the range of L1 + 15%, shall be given the opportunity in order of their ranking (starting with the

	<p>lowest quoted MSE bidder and so on) to bring down its price to match with L1 bidder. Award shall be placed on the MSE vendor who matches the price quoted by L1 bidder.</p> <p>3.3. If no MSE vendor who has quoted within range of L1 + 15% accepts the price of L1 bidder then the award shall be made to the L1 bidder.</p> <p>4. Note: Generally, in tenders having Item-wise evaluation, splitting is allowed unless otherwise specified in the Special Conditions of Contract (SCC). Further, in tenders having Package wise evaluation generally splitting is not allowed. Please refer Special Conditions of Contract for specific tender provisions.</p> <p>5. If the quoted products are registered under supplier category in any government site / portal then such material shall not be considered under MSE category. As per answer to FAQ no. 18 circulated vide Office Memorandum F. No. 22(1)/2012-M A dt. 24.10.2016 "Policy is meant for procurement of goods produced and services rendered by MSEs. However, traders are excluded from the purview of benefits and exemption of MSEs.</p> <p>6. In case, Bidder is not a manufacturer of all such items which are a pre-requisite for extending MSE benefits of purchase preference, but is a manufacturer of atleast one of the item(s) of the package, then benefits of EMD and Tender fee exemption only shall be extended in such cases and its bid shall be evaluated treated as Non-MSE bid.</p> <p>7. In support of above claim regarding manufacturing of each of the specified Item(s), Bidder will furnish necessary details of Stores/ Category of items etc. as mentioned in the 'Udyam Registration Certificate' along with the above Undertaking. In case, such details are not available in the Registration Certificate furnished by the Bidder for any of the above item(s), other relevant details / documentary evidence will be furnished along with the Undertaking in support of the claim that such item(s) are manufactured by the Bidder.</p>
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HINDUSTAN URVARAK & RASAYAN LIMITED

(A JOINT VENTURE OF CIL, NTPC, IOCL, FCIL & HFCL)

BARAUNI UNIT

Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]



SECTION – V

(SOR, TECHNICAL SPECIFICATIONS

SCOPE OF WORK AND OTHER TERMS & CONDITIONS)

Below is a comprehensive list of the annexures, supporting documents, and BoQ along with their respective page numbers. These documents collectively constitute an integral part of our tender submission, offering detailed insights into our proposed approach and technical specifications

Sl. No	Name of Documents
1	Annexure-I (Scope of Work Bay 6 & 7)
2	Annexure-II (SOW & SCC-Civil)
3	Annexure-III (SOW and Technical specifications - Electrical)
4	Annexure-IV (Technical_Specification_for_Communication_equipment)
5	Annexure-V (SLD of 132KV Bay)
6	Bill of Quality (BoQ)

(Note: Above mentioned Annexure- I to V only related to Section-V)

Scope Of Work (SCC)

Refurbishment of 132kV Bay and Transmission Line at HURL-Barauni

The electrical power requirement for operation of HURL Barauni fertilizer plant shall be met by inhouse captive power generation along with power back up from grid. The grid power requirement at 132kV level will be received through Bihar State Electricity Board from 132kV switchyard of NTPC-BTPS.

Major scope of work: Refurbishment of 132kV Bay and Transmission Line at HURL Barauni. Job includes supply, installation, testing & commissioning of bay and transmission line including route survey, detailed feasibility report, transportation of all equipment & material to site including loading, unloading, storage, required civil, mechanical, electrical and instrumentation works, Statutory compliances(State Electricity Board(BSPTCL), SLDC, CEA, First time charging, PTCC, Telemetry Clearances, NTPCClearances, etc.

Supply, installation, testing & commissioning of 132kV Bay 6 & 7 at BTPS Barauni and D/C Transmission Line at HURL Barauni. Major scope includes –

- Supply, erection, testing and commissioning of 132kV Bay equipment in Bay No. 7 (inside NTPC-BTPS premises).
- Dismantling of Bay 5 equipment followed by erection and commissioning of same equipment at Bay 6 – NTPC – BTPSBarauni.
- Connection of 132kV Bay No. 6 & 7 with existing old 132kV transmission line (From NTPC-BTPS to HURLBaraunipremises).
- Supply & erection of missing conductors in the existing old 132kV transmission line as required (outside NTPC-BTPS&HURL Barauni premises).
- Civil Works like Equipment Foundations and structures for Bay 6 & 7 at NTPC-BTPS Barauni.
- Connection of existing old 132kV transmission line with HURL Barauni 132kV switchyard (inside HURLpremises).
- All Statutory compliances required for Charging of Bay 6 & 7 and transmission lines are in vendor's scope without any extra cost implications to Owner.
- Gatepass, Safety Permits, JSA, HIRA and necessary approvals at NTPC – BTPS Barauni are in Vendors Scope.
- Third Party Inspection of Equipment or coordinating with BSPTCL for same, is in Vendor Scope without any Extra Cost Implications.
- Protection Relay Settings, Coordination & Communication between NTPC – BTPS Barauni and HURL Barauni Switchyard is in Vendor Scope. All relay settings and calculations to be provided by vendor to OWNER for review.
- ABT Meter data communication with respective State Authority to be ensured by the Vendor without any extra costimplication.
- Equipment Data as required by the SLDC and all the clearances regarding same is in Vendor Scope without any extracost implication, necessary equipment for data communication to SLDC to be installed by vendor.
- First Time Charging Clearances with respective authorized regulatory bodies is in vendor scope without any extra costimplication.
- PTCC Clearance with respective authorized regulatory bodies is in vendor scope without any extra cost implication.
- All SLDC compliances and communication, all permission and its processing work till the completion of proper communication and confirmation from SLDC will be in Vendor Scope without any extra cost implication.
- All safety Compliances to be ensured by Vendor as per HURL / NTPC safety guidelines.
- Vendor to carry out detailed feasibility site inspection and Feasibility report to be submitted for Owner Review.
- Vendor to submit Job Plan Schedule for Material Delivery and Site activities. Same shall be considered for ProjectTimeline. In case of any deviation or delay from Job Plan Schedule, vendor needs to provide Delay Analysis Sheet.
- All LIU, communication cables, patch cables, softwares and final backup files required to communicate with Relays orother equipments to be provided by Vendor without any extra cost implication.
- Vendor to submit a detailed Scheduled Plan including day wise details regarding Supply, Erection, commissioning, statutory jobs compliances etc. jobs related till final completion in

all respects. (Vendor to submit one Hard(A3) signed and Soft copy of same) at the time of MOM.

- Vendor to Provide Details of Hierarchy / Site Manpower (Project Coordinating Team) i.e. 1 Nos. RCM for Project Co-ordination & Planning, 1 Nos. – Engineer In charge Each (Civil & Electrical Jobs), 1 Nos. Safety In charge with Proper Contact Details at the Time of MOM, apart from other Project Execution Team.
- All works to be carried out prior proper submission of JSA, HIRA and Works Permits. Engineer Incharge & Safety officer shall always be present at site at the time of Job Execution.
- Vendor To submit calibration and Test Certificates of all Safety Equipment's, tools and tackles and Testing Equipment's to owner at least 7 Days Before using at Site.
- Warranty of Supply Items will be 18 Months from the date of receipt at Site or 12 Months from the date of commissioning.
- Defect Liability Period will be 12 Months from the Date of Complete Commissioning.
- Vendor to Submit all the Warranty and Guarantee Certificates in Hard as well as in soft. Vendor to provide a list of Equipment with its Warranty Certificate Details.

Terms & Conditions:

- 1.1. All the works are to be executed as per description in the schedule of rates, technical specifications and as per the directions of E-I-C.
- 1.2. The work involves working in all locations and under all conditions and for all surfaces, plain, curved, etc. The rates quoted shall be deemed to cover working under adverse conditions as well as supervision from the contractor's side. No plea whatsoever on any accounts for reconsideration of rates will be entertained.
- 1.3. The quantities given in the Schedule of Rates are only indicative and may vary during execution as per site and other exigency requirements. The total quantum of work may vary up to 25% and nothing extra over the unit rate as mentioned in SOR will be paid on this account. Quantum of individual item may vary to any extent.
- 1.4. The tenderers shall note that the quantities of the different items, as given in the "Schedule of Rates" are tentative, and are subject to variation and they shall not be entitled to claim any higher rate or compensation on this account. Owner reserves the right to change/ modify the size and type of sections at any time. HURL does not guarantee work under each item of the Schedule of Quantities.
- 1.5. The contractor will not be entitled for compensation for any variation in quantity whatsoever, if the executed quantity is less than the quantity indicated in the estimate. The Engineer-in-Charge reserves the right to order any item/items independently as may be considered expedient. The contract shall be bound to execute any item/items of the tender at his quoted rates as and when called upon to do so. The rate(s) quoted shall be deemed to cover working under adverse conditions as well as supervision from the contractor's side.
- 1.6. The contractor will have to work in close co-operation and co-ordination with other agencies on the site. No extra claim on this account shall be payable by the owner.
- 1.7. Materials obtained from dismantling and renewal works, shall remain the property of the owner. The contractor shall sort out and stack the serviceable materials obtained, as above and deposit as per direction of owner. The unserviceable materials shall be disposed-off to the place specified in the tender or as directed by the Engineer-in- charge.
- 1.8. Any Crop Compensation required during execution of job will be in Vendor Scope without any extra cost implication.
- 1.9. Spares as Indicated in SOR to be provided by the Vendor, same to be handed over at the time of project completion at HURL Barauni Stores.
- 1.10. Time of completion of the work shall be 8 (eight) months from date of handing over of site.

1.11. Payment Terms & Security Deposit:

1.11.1. Payment Terms:

1.11.1.1. Progress Payments shall be released to CONTRACTOR against monthly running account bills duly certified by Engineer-in-charge after affecting the necessary deductions. The basis for payment against various items shall be below:

1.11.1.1.1. A) SUPPLY ITEMS

- i. 80% on receipt and acceptance of equipment at site
- ii. 15% after Erection / Installation
- iii. 05% on Commissioning / Completion of all works including all statutory compliances in all respects and acceptance thereof by EIC.

1.11.1.1.2. B) ERECTION ITEMS

- i. 80% on completion of Erection / Installation works
- ii. 15% on Testing & Acceptance of works
- iii. 05% on Commissioning / Completion of all works including all statutory compliances in all respects and acceptance thereof by EIC.

1.11.1.2. The Bidder is required to furnish the requisite CPBG as mentioned in GCC/SCC.

1.11.1.3. In case of breach of contract, the guarantee amount shall be encashed by the Owner without any conditions whatsoever.

1.11.2. Tax deduction at source Income tax, as applicable as per income tax act, shall be deducted at source from the Contractor's bills and a certificate towards this deduction shall be issued to the Contractor.

1.11.3. Price Basis: Shall be firm till the completion of the contract.

1.12. In case of any class of work for which there is no specification supplied by the owner, such work shall be carried out in accordance with Indian standard specifications OR PGCIL Standards OR BSPTCL Standards and if the Indian Standard specifications do not cover the same, the work shall be carried out as per Standard engineering practice subject to approval of the Engineer-in-charge.

1.13. Unless otherwise expressly stipulated in the specifications all mode of measurement shall be as laid down in IS Codes. Wherever any dispute regarding mode of measurement arises, the decision of the Engineer-in-charge shall be final and binding on the contractor

1.14. All electrical works shall be carried out through supervisors holding electrical supervisory license issued by the competent authority.

1.15. Proper line clearance shall be obtained by the contractor from the electrical division of the owner wherever works are to be carried out near electrical installations, near cable routes or any other electrical equipments.

1.16. Open space available for storage of materials can be provided at sites, the contractor shall be responsible for cleaning leveling and making area suitable for storage of materials and clearing the same after completion of the work. Security of the material will be in the contractor's scope at NTPC Barauni and at HURL Barauni without any extra cost implications. No residential accommodation will be provided.

1.17. The contractor shall on award of the work, appoint a qualified Engineer at site to be responsible for the proper execution of the work to whom site instruction and orders can be given. The contractor's site Engineer shall be responsible for the supervision, co-operation and inspection of the day-to-day work.

1.18. The contractor shall engage qualified and experienced supervisors (minimum Diploma/ITI certificate holders in relevant field) and/or having sufficient experienced to supervise the execution of work constantly for job at his own cost.

1.19. No tools will be provided to the contractor from the owner. The contractor will have to arrange for their own tools, and equipment which may be necessary for smooth execution of the work. All Tools

and equipments shall be inspected and certified by Third Party Inspector. All the Gatepass required for Manpower and tools entry will be sole responsibility of Contractor.

- 1.20. The contractor shall provide necessary information regarding his own tools and other construction aids he intends to utilize for the fulfillment of this contract in the form provided for that purpose in this tender.
 - 1.21. All the materials shall be supplied by the contractor unless otherwise mentioned clearly in the item under Schedule of Rates. Crop Compensation or any ROW required during project execution will be in Vendors scope.
 - 1.22. The contractor shall abide by the safety, fire and security regulations as per direction of EIC.
 - 1.23. Commissioning Scope: Commissioning of all equipments will be in vendor scope. Vendor to ensure proper commissioning of equipments, Relay, Panel, Lighting, Earthing, Communication System etc. as per the site plan and commissioning report for each equipment to be submitted with commissioning date, tests and commissioning details.
 - 1.24. The contractor has to ensure that all the contract laborer's of any skill are provided with all safety appliances from top to toe like safety helmet, safety goggles, safety belts, safety shoes/gum-boots, protective clothes, etc. for complying with the Safety Rules by the contractors. The quoted price/rates should include the cost of providing all this safety equipment. The contractor shall be held fully responsible for any violation of the above if noticed by statutory bodies at any time during the execution of work and they shall be penalized as deemed fit.
- 1.21 Accommodation & Transportation: All boarding / lodging / Transportation / Local conveyance of workman engaged shall be in the scope of Contractor.

ADDITIONAL SPECIAL CONDITION
OF CONTRACT (SCC)

(i) Schedule of contract:

- The total contract period shall be 8 months from the site handover date. Vendor shall submit the detail schedule for completion of job within contract period. Schedule shall include details of Kick off meeting, List of documents / drawings submission & approval, procurement and ordering details, pre dispatch inspection plan, erection schedule, testing & commissioning schedule etc.
- CONTRACTOR shall report fortnightly to OWNER, the progress of the execution of CONTRACT and achievement of targets set out in time bar chart.
- The progress will be expressed in percentages shown in the progress trend chart.
- The first issue of the progress trend chart will be forwarded together with the time bar chart along with CONTRACT confirmation.
- The monthly reporting will be the updating of the progress trend chart.
- OWNER or his representatives shall have the right to inspect CONTRACTOR's premises to evaluate the actual progress of WORK on the basis of CONTRACTOR's time schedule documentation. Irrespective of such inspection, CONTRACTOR shall advise OWNER at the earliest possible date of any anticipated delay in the programme indicating the reasons thereof and corrective measures proposed thereto.
- CONTRACTOR shall report monthly to OWNER of the execution of CONTRACT and achievement of targets set out in time bar chart, in a monthly progress report on 25th of every Month.
- CNTR shall also submit daily progress report on duly approved DPR format.

(ii) **Proposed supply vendor list:** The proposed vendor list for the supply items is given below. Make of the equipment not indicated and any other additional vendor make for the specified equipment shall be subject to owner's approval. Additional vendor shall have well proven record of the specified items.

ITEM	NAME OF THE VENDOR	COUNTRY
PROTECTIVE RELAYS		
1.	AREVA	INDIA
2.	ASEA BROWN BOVERI LTD.	INDIA
3.	LARSEN & TOUBRO LTD. (EL. PRODUCTS DIVN.)	INDIA
4.	SIEMENS LTD.	INDIA
5.	EASUN REYROLLE LIMITED	INDIA
SWITCHYARD PACKAGE		
1.	ALSTOM LIMITED (AREVA T & D)	INDIA
2.	ASEA BROWN BOVERI LTD.	INDIA
3.	BHEL (ELECTRICAL MACHINES DIVN.)	INDIA
4.	CROMPTON GREAVES LTD.	INDIA
5.	KIRLOSKAR ELECTRIC COMPANY LTD.	INDIA
6.	L&T (ECE DIVISION)	INDIA
7.	MEHRU ELECTRICALS (FORMERLY AUTOMATIC ELECTRIC LIMITED)	INDIA
8.	RELIANCE POWER	INDIA
9.	REUNION ELECTRICAL MANUFACTURERS (P)LTD.	INDIA
10.	SIEMENS LTD.	INDIA
11.	THE AHMEDABAD ELECTRICITY CO LTD.	INDIA
12.	VOLTAS LTD. (PUMPS & PROJECTS BUSINESS DIV.)	INDIA
EHV/HV INSULATORS		
1.	ALSTOM LIMITED (AREVA T & D)	INDIA
2.	BHARAT HEAVY ELECTRICALS LTD.	INDIA
3.	SESHASAYEE INDUSTRIES LTD.	INDIA
4.	ADITYA BIRLA	INDIA
5.	YAMUNA POWER & INFRASTRUCTURE	INDIA
6.	CJI PORCELAIN PVT. LTD.	INDIA
7.	MODERN ABROAD	INDIA
8.	IEC BHOPAL	INDIA
9.	SARVANA CUDDATORE	INDIA
LIGHTNING ARRESTOR		
1.	ALSTOM LIMITED (AREVA T & D)	INDIA
2.	CROMPTON GREAVES LTD.	INDIA
3.	ELPRO INTERNATIONAL LTD.	INDIA
4.	OBLUM ELEC. INDUSTRIES PVT LTD.	INDIA
EHV SWITCHES/ISOLATORS		
1.	ELPRO INTERNATIONAL LIMITED	INDIA

2.	S & S POWER SWITCHGEAR LTD.	INDIA
3.	TRANSLECT	INDIA
4.	CGL	INDIA
5.	GR Power	INDIA
6.	Siemens	INDIA
7.	Electrolite Jaipur	INDIA
8.	GK Electricals	INDIA
CIRCUIT BREAKERS, 66KV & ABOVE		
1.	ASEA BROWN BOVERI LTD.	INDIA
2.	BHEL (ELECTRICAL MACHINES DIVN.)	INDIA
3.	CROMPTON GREAVES LTD.	INDIA
4.	VOLTAS LTD. (PUMPS & PROJECTS BUSINESSDIV.)	INDIA
5	SIEMENS	INDIA
6	AREAVA/ALSTOM (GE T&D)	INDIA
CURRENT TRANSFORMERS, 66KV & ABOVE		
1.	ASEA BROWN BOVERI LTD.	INDIA
2.	BHEL (ELECTRICAL MACHINES DIVN.)	INDIA
3.	CROMPTON GREAVES LTD.	INDIA
4.	MEHRU ELECTRICALS (FORMERLY AUTOMATICIELECTRIC LIMITED)	INDIA
5.	NAGPUR TRANSFORMERS LTD.	INDIA
6.	TRANSFORMERS & ELECTRICALS KERALA LTD.	INDIA
POTENTIAL TRANSFORMER, 66KV & ABOVE		
1.	ASEA BROWN BOVERI LTD.	INDIA
2.	BHEL (ELECTRICAL MACHINES DIVN.)	INDIA
3.	CROMPTON GREAVES LTD.	INDIA
4.	MEHRU ELECTRICALS (FORMERLY AUTOMATICIELECTRIC LIMITED)	INDIA
5.	NAGPUR TRANSFORMERS LTD.	INDIA
6.	TRANSFORMERS & ELECTRICALS KERALA LTD.	INDIA
ABT METERS		
1.	SECURE METERS	INDIA
CONTROL & RELAY PANEL		
1.	AREVA	INDIA
2.	ASEA BROWN BOVERI LTD.	INDIA
3.	LARSEN & TOUBRO LTD. (EL. PRODUCTS DIVN.)	INDIA
4.	SIEMENS LTD.	INDIA
FLAMEPROOF LOCAL CONTROL STATION, JUNCTION BOX, LIGHTING FITTING, PLUG, SOCKET, HAND LAMP, ACCESSORIESLIGHTING, DISTRIBUTION BOARD & CONTROL PANEL		
1.	FCG FLAMEPROOF CONTROL GEARS PVT. LTD.	INDIA
2.	BALIGA LIGHTING EQUIPMENTS LTD.	INDIA
3.	SUDHIR SWITCHGEARS PVT. LTD.	INDIA
4.	FLAMEPROOF EQUIPMENTS PVT. LTD.	INDIA
5.	FLEXPRO ELECTRICALS PVT. LTD.	INDIA
6.	GOVAN INDUSTRIES (INDIA) PVT. LTD.	INDIA

STREET/FLOOD LIGHTING FIXTURES		
1.	CROMPTON GREAVES LTD.	INDIA
2.	PHILIPS INDIA LTD.	INDIA
3.	BAJAJ ELECTRICALS LTD.	INDIA
4.	WIPRO LIGHTING	INDIA
5.	HAVELL'S INDIA LTD.	INDIA
LIGHTING POLES		
1.	BHARATI EXPORTS	INDIA
2.	METALITE INDUSTRIES	INDIA
3.	PREMIER POWER PRODUCTS (CALCUTTA) PVT. LTD.	INDIA
4.	SADHANA ENGINEERING CORPORATION	INDIA
HOSE PROOF INDUSTRIAL LIGHTING FIXTURES		
1.	BAJAJ ELECTRICALS LTD.	INDIA
2.	CROMPTON GREAVES LTD.	INDIA
3.	PHILIPS INDIA LTD.	INDIA
4.	WIPRO LIGHTING	INDIA
HOSE PROOF LOCAL CONTROL STATION/INDUSTRIAL TYPE SWITCH SOCKET & PLUG		
1.	BALIGA LIGHTING EQUIPMENTS LIMITED	INDIA
2.	FLAMEPROOF EQUIPMENTS PVT. LIMITED	INDIA
3.	FCG POWER INDUSTRIES LTD.	INDIA
4.	FCG FLAMEPROOF CONTROL GEARS PVT. LTD.	INDIA
CABLE TRAYS		
1.	GLOBE ELECTRICAL INDUSTRIES	INDIA
2.	METALITE INDUSTRIES	INDIA
3.	STEALITE ENGINEERING CO.	INDIA
4.	RUKMINI ELECTRICALS & COMPONENTS PVT.LTD.	INDIA
5.	PAREKH ENGINEERING COMPANY	INDIA
6.	SADHANA ENGINEERING CORPORATION	INDIA
7.	INDIANA ENGG. WORKS PVT. LTD.	INDIA
8.	PREMIER POWER PRODUCTS (CALCUTTA) PVT.LTD.	INDIA
FLOOR MOUNTED DISTRIBUTION BOARDS		
1.	ELECMECH CORPORATION	INDIA
2.	INTRELEC	INDIA
3.	CONTROLS & SWITCHGEAR CO. LTD.	INDIA
4.	GLOBE ELECTRICAL INDUSTRIES	INDIA
5.	REUNION ELECTRICAL MANUFACTURERS (P)LTD.	INDIA
6.	UNIVERSAL INDUSTRIAL PRODUCTS	INDIA
7.	VIDHYUT CONTROL (INDIA) PVT. LTD.	INDIA
WALL MOUNTED DISTRIBUTION BOARDS		
1.	ELECMECH CORPORATION	INDIA
2.	INTRELEC	INDIA

3.	CONTROLS & SWITCHGEAR CO. LTD.	INDIA
4.	GLOBE ELECTRICAL INDUSTRIES	INDIA
5.	REUNION ELECTRICAL MANUFACTURERS (P)LTD.	INDIA
6.	HAVELLS INDIA LTD.	INDIA
7.	INDO ASIAN FUSEGEAR LTD.	INDIA
8.	LEGRAND INDIA LTD.	INDIA
EARTHING & LIGHTNING PROTECTION MATERIAL – (GI) WIRE/STRIP		
1.	ANAND ELECTRIC TRADING CO.	INDIA
2.	BHARTI EXPORTS	INDIA
3.	CONTROLS & SWITCHGEAR CO. LTD.	INDIA
4.	JAYANT METAL MFG. CO.	INDIA
5.	METALITE INDUSTRIES	INDIA
6.	PREMIER POWER PRODUCTS (CALCUTTA) PVT.LTD.	INDIA
HT POWER AND LT POWER & CONTROL CABLES		
1.	RAVIN CABLES LIMITED	INDIA
2.	KEC INTERNATIONAL LIMITED (FORMERLY RPGCABLES LIMITED)	INDIA
3.	KEI INDUSTRIES LTD.	INDIA
4.	NICCO CORPORATION LIMITED	INDIA
5.	TORRENT CABLES LIMITED	INDIA
6.	UNIVERSAL CABLES LTD.	INDIA

NOTE: Make of the equipment not indicated and any other additional vendor make for the specified equipment shall be subject to owner's approval. For this credential of the additional vendor shall be furnished by the contractor.

(iii) **Manufacturing Quality Plan:** Vendor shall execute the manufacturing quality plan as per approved MQP subjected to approval from OWNER.

(iv) **Pre-Dispatch inspection plan:** Inspection and tests

- Routine tests shall be carried out at works in the presence of Third party inspector as per relevant IS / IEC Standards. Site Inspection Reports and Test copies for the same to be submitted for OWNER Review.
- Vendor shall furnish type and routine test certificates for all bought out components for the panel, as per relevant standards.
- Test certificates for type test carried out on similar equipment of identical design, if available, shall be submitted.
- Pre-Dispatch inspection shall be carried out as per approved manufacturing quality plan. Pre-Dispatch inspection shall be in bidder / vendor scope. No extra payment shall be made by owner for the pre dispatch inspection / tests etc.
- Vendor shall intimate Factory Acceptance Test (FAT) of equipment's 15 days in advance through written communication to Client. Owner post receipt of intimation, may conduct the virtual/ onsite FAT.

(v) **Site Quality plan:** Vendor shall furnish the field / site quality plan for review and approval.

(vi) **Protection Relay :**

- Differential Protection Relay(87 L) : Siemens make numerical relay Type-7SD6101-6BB99-1BJ0+LOR+M2G (Single Mode)
- Feeder Protection Relay : Siemens make numerical relay Type-7SJ66-6KB90-1FG4+LOR
- Lockout Relay shall be VAJH type only.

4.) Trip Circuit supervision Relay shall be VAX type only.

(vii) Inspection & Testing:

Equipment's shall be inspected by either of the Third Party Inspection agency as below :

1. TUV SUD
2. TUV Nord
3. IR Class
4. Lloyds
5. BV
6. PDIL

The inspection and Testing shall be in accordance with the all relevant codes, standards, specifications.

(viii) Documentation: For documentation following should be followed: Note: 3 set hard copies & 2 set softcopies in CD/pen drive shall be submitted as final documents.

Sl. No.	Document Description Documents Required (Y / N)	Documents Required (Y / N)	
		For Approval	Final
1.	Specification Sheet and Technical Particulars completely filled-in	Y	Y
2.	General Arrangement drawing with dimensions & weight	Y	Y
3.	Terminal Arrangement	Y	Y
4.	drawing Connection	Y	Y
5.	Diagram	N	Y
6.	Illustrative and Descriptive catalogues	N	Y
7.	Catalogues of bought out accessories	N	Y
8.	Recommended Spare parts list of	N	Y
9.	equipment's	N	Y
	Installation, Operation and Maintenance manual	N	Y
	Test certificates	N	Y
	a) Routine		
	b) Type		
	c) Acceptance		
	Guarantee Certificates		

SCOPE OF WORKS

Construction of 2No. 132KV line bay for HURL at NTPC, BTPS

Brief Scope of work

The scope shall consist of but not limited to the Construction of Equipment foundations including all civil as per SOR. Any addition / alteration / construction work carried out in the Bill of Quantities and other miscellaneous work.

The scope of work shall also include any other item of work required to complete the work in all respects as per the specifications, drawings and instructions of Engineer-in-charge whether specifically mentioned or not in the tender documents.

Special condition of contract

1. Provision of all necessary labors, construction equipment, instruments and appliances in connection with all above mentioned work as specified or as directed by Engineer-in-Charge or the representative of Engineer
2. Any other item of work as may be required, to be carried out as per CPWD specifications, for completing the job in all respects in accordance with the provisions of contract and or to ensure the structural stability and safety of the work during and after construction
3. CPWD Specifications will be applicable for methodology of execution of work for all DSR items. For NDSR items methodology as per relevant IS codes or structural drawing with method statement shall be provided by Engineer in charge
4. The work shall be carried out as and when required by HURL with all safety precautions.
5. The contractor shall ensure all his workers shall have Personal Protective Equipment's (PPE"s) at his cost (not to be charged to the worker) and ensure safety of site by providing Barricades for restricting movement of public to work area. The barricade arrangement shall be approved by Engineer in charge keeping in view the overall circulating pattern of the commuters in the station
6. The work is to be carried out in an orderly manner without noise and obstruction to flow of traffic.
7. All rubbish etc. is to be disposed on designated place as per instruction of EIC at the earliest and the place is left clean and orderly at the end of each day's work.
8. The Contractor shall ensure that his Construction work staff is qualified and licensed for their part of work. He shall be responsible for their conduct. The staff should behave in a courteous manner. The contractor shall be held responsible for any loss or damage to HURL property (If any).
9. The contractor shall ensure safety of his workers and others at site of work and shall be responsible for any consequence arising out of execution of the work.

10. When instructed to do so, the contractor shall ensure proper record keeping and storing of irreparable/dismantled material.
11. Water and electricity shall be made available free of cost at nearby source of work. The contractor has to make his own arrangement for use of the same including extending temporarily lines etc. The responsibility for following relevant rules, regulations and loss in the regard shall be entirely that of the contractor
12. The scope of the contract includes daily inspection of the premises by the contractor himself, identifying the defects, make a proposal to the engineer, obtain his approval and carry out the work. In general, responsibility of the site kept cleaned and updated position will rest with the contractor
13. The work shall be carried out as and when required by HURL with all safety precautions.

Terms and Condition:

1. The quantities given in the Schedule of Rates are only indicative and may vary during execution as per site and other exigency requirements. The total quantum of work may vary up to 25% and nothing extra over the unit rate as mentioned in SOR will be paid on this account. Quantum of individual item may vary to any extent.
2. The payment shall be released as per monthly RA Bills with all statutory deduction.
3. The contractor will have to engage one (01) civil work experienced supervisor for the supervision and co-ordination of repair/renovation works. He should be available during working hours for taking instruction of EIC for which no extra payment shall be made by HURL, failing which deduction of Rs300.00 per day shall be deducted from contractor's RA Bill.
4. For proper execution of work sufficient numbers of tools & tackles are to be provided by the agency at their own cost, nothing shall be paid extra for this.
5. The contractor shall abide by all statutory rules and regulations of Local authority, State and Central Govt. as the case may be with regard to statutory benefits and non-statutory benefits prevailing at HURL-Barauni as applicable, at his own cost and hence the agency has to quote their rate accordingly by taking care of all these.
6. The contractor shall have P.F. code no. As per statutory requirements of provident fund Act, and extend the facilities of P.F. contribution of the act at his own cost and no extra claim shall be entertained by HURL on this account.
8. The contractor shall have to comply with the provision of payment of wages Act, 1936 minimum wages Act, 1948, Employee liabilities 1938, Workers compensation Act, 1923. Industrial dispute Act, 1947, contract labour (Regulation and abolition) Act, 1970 with latest modification thereof or any other related law and rules made time to time. No extra claim shall be entertained by HURL on this account.
9. HURL reserve the right to terminate the contract at any time during the contract period in case performance is not found satisfactory and work not carried as per instruction of Officer-in-charge.

10. The price shall be firm and no variation shall be allowed on any account till execution of complete work.
11. Submission of Invoice: All invoices to be raised in the name of Hindustan Urvarak & Rasayan Limited and will be submitted to EIC, HURL Barauni (Bihar).
12. In the view of pandemic situation contractor have to provide a transit camp for sheltering the manpower involved in work, If needed and all required PPEs should be followed by the worker and issuance of the required PPE's is under contractor scope.
13. The Manpower/ supervisor deployed by the contractor shall ensure that the HURL properties are protected from theft/pilferage/ damage. After necessary investigation, if proved that the contractor/ their personnel are responsible for the incident, the contractor is liable and will be penalized to the extent of the value of the loss and additional charges for each incident as decided by the competent authority of HURL.
14. HURL is not liable at any stage to provide accommodation, transport, food, medical and any other requirement of their personnel deployed at the HURL site.
15. Contractor shall have to complete the work or early completion of emergency maintenance work within short notice as desired by HURL Engineer in Charge (EIC) by increasing of manpower, material, T&P etc. for which no extra cost will be paid.
16. All boarding/ lodging/ Transportation/ Local conveyance of workman engaged shall be in the scope of contractor.
 17. In general, the services are to be provided on all working days.
 18. The client shall have the right to have any person removed, who is considered to be undesirable or otherwise and similarly the contractor reserves the right to remove the personnel with prior permission of the client, emergencies exempted.
 19. The contractor shall depute one full time Supervisor, who shall ensure that all the duties assigned to the firm by HURL must be performed by them in the desired manner.
 20. Damage caused to properties of HURL if any, during execution of above work shall be rectified by the contractor at his cost failing which the cost of rectification shall be recovered at market cost of such items from the next R/A Bill / Final Bill of the work contract.
 21. The work shall be carried out as and when required by HURL with all safety precautions. Penalty of Rs.500 will be imposed if personnel found without PPE's or engaged in unsafe work.
 22. The contractor shall be supposed to have quoted rates, after inspection of location and having considered all the factors i.e., working at height, payment of minimum wages, insurance, labour license, P.F and other statutory contractual obligation.
 23. All materials, T&P, Labours, Scaffolding/Working platform of support required for Safe and satisfactory work shall be arranged by the contractor at his own cost.
 24. Cost of transport, loading, unloading etc. from EIC's stores to work site etc., will be on Contractor's account.
 25. The contractor will produce documentary evidence for all bought out items to be used in the work if the same is asked by Engineer in Charge.
 26. The contractor will maintain all statutory registers and records in the proper manner as required by the regulation of various authorities concerned. The HURL will not be responsible for the consequence due to any incorrect and or faulty documentation on the part of the contractor.
 27. The Rates quoted shall include for payment of royalties for obtaining earth, morrum, sand, aggregates, stones, etc. Nothing extra shall be paid to the Contractor on this account.

28. If specification for an item of work is not covered by CPWD/BIS specifications, the same shall be decided by the EIC and shall be binding on the Contractor.
29. The EIC shall have the right to cause the Contractor to purchase and use such materials of particular make or from a particular source which may in his opinion be necessary for proper and reasonable compliance with the specifications and execution of work.
30. As and when required by the EIC the Contractor shall provide all facilities at site or at manufacture's works or in approved laboratory for testing of materials and/or workmanship. All the expenditure in respect of this shall be borne by the Contractor. The Contractor shall, when required to do so by the EIC, confirm that the materials have been tested in accordance with requirements of the specifications.
31. Contractor shall be responsible for making all necessary approach roads to the sites of execution for taking his equipments. No extra claim in this regard shall be entertained.
32. The Contractor shall follow all rules and regulations for entry / exit of their men and materials in/from project site as framed by EIC.
33. The EIC shall have authority to stop the work, whenever such stoppage may become necessary to ensure the proper execution of the contract. He shall also have authority to inspect and reject all work and materials which do not conform to specifications, to direct the application of Contractor's forces to any portion of the work, as in his judgment is required, and to order the said force increased or diminished and to decide questions which arise in the execution of the work.
34. The EIC reserve the right to suspend the work or part thereof at any time and no claim whatsoever on this account shall be entertained. In case of any clarification the Contractor may appeal to the EIC whose decision shall be final and binding thereupon.
35. The above inspection shall, however, not relieve the Contractor of his responsibilities in regard to defective materials or workmanship and the necessity for rectifying or replacing the same.
36. The judgment of EIC for determining the category of an item not mentioned in the schedule shall be final.
37. The Contractor agrees to give the guarantee of his works in the following manner which shall remain valid till the validity of performance guarantee:-
 - (i) All equipments / materials incorporated in the work shall be new and both workmanship and materials shall be of good quality.
 - (ii) Should, at a subsequent date, any inside honeycomb/hollowness be detected within a concrete member, he shall investigate other nearby sections for similar occurrence and shall rectify all these members by Pressure grouting at his own cost and as per direction of the EIC
 - (iii) Should, any element of the structure be detected afterwards not exactly tallying with the working drawing, he shall re-do the element at his own cost and as per instruction of the EIC.
 - (iv) Should, at a subsequent date, any equipment / materials or fittings or workmanship or any element of the structure be detected as of sub-standard quality he shall either remove the same and shall re-do at his own cost or shall accept an equitable deduction in the contract price should the EIC deem it inexpedient to correct the work.
 - (v) Should, at a subsequent date, the basement wall/floor be noted seeping/leaking he shall rectify the same by pressure grouting at his own cost and as per direction of the EIC.
38. For all RCC elements, both underground and above ground, only new plywood and steel shuttering shall be used to produce the concrete surface reasonably plain and smooth which will be integrally finished surface. Any little unevenness shall be made good by rubbing with carborandum stones only. Unless otherwise mentioned, plastering will not be allowed to manipulate and make the surface plain and smooth.

39. If the surfaces after stripping off the shuttering are found to be contrary to the above conditions then the Contractor shall have to dismantle the member and re-do the same to attain the aforesaid surfaces at his own cost.
40. The Contractor shall be responsible for the manner and the method of executing the work. The work shall be subject to the approval of EIC from time to time for purposes of determination of the question whether the work is executed by the Contractor in accordance with the contract.
41. Nothing extra shall be paid for any intricate concrete, shuttering or reinforcement work for foundations of equipment and machinery and for other foundation/superstructure works or for any delay inherent in concreting in small and thin sections in concrete or RCC works etc
42. Nothing extra shall be paid in concrete/RCC works for all rebating, chamfering, grooving, sinking, trotting weathering, molding, etc. to accord with the details shown on the working drawings.
43. In case any claim with regard to the wages of any labour employed by Contractor for the subject job is pending/ reported, EIC shall be fully entitled to withhold payment of final bill pending finalisation of such claims.
44. If it shall appear to the EIC or his representative, that any work has been executed with unsound, imperfect or unskilful workmanship or with materials of any inferior description or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or otherwise not in accordance with the contract, the Contractor shall, on demand in writing from the EIC specifying the work/materials/articles complained, notwithstanding that the same may have been inadvertently passed, certified and paid for, forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require, or as the case may be, remove other unsuitable materials or articles so specified within a period specified by the EIC at his own cost.
45. The site shown on the layout plan shall be cleared by the Contractor of all obstructions, loose stones, materials, rubbish of all kinds of bushes, trees, grass as well as brush wood. All holes/hollow, whether originally existing or produced by removal of loose stones or brush wood, shall be carefully filled up with earth, well rammed and leveled off as directed by the EIC. The Contractor will not be entitled to any payment in his regard.
46. The Contractor shall use the materials only after the approval of EIC, before incorporation of the same in the works.
47. At the request of EIC, Contractor shall at his expense, dismiss from work and replace any such employee as EIC, may deem incompetent or careless or whose continued employment is deemed inimical to the interest of the EIC or against public interest.
48. To determine the acceptable standard of workmanship, EIC may order Contractor to execute certain portions of work and services such as wall, flooring, joinery, finishes, roads and the like under the close supervision of EIC. On approval, these items shall be labeled as guiding samples and work shall be executed to conform to these samples. These samples shall be prepared at the cost of Contractor.
49. Workmanship shall be of best possible quality and all the work shall be carried out by skilled workmen except for those which normally require unskilled persons. If the laws of local government, municipal or other authorities require employment of licensed or registered workmen of various trades, Contractor shall arrange to have the work done by such registered or licensed persons.
50. Workmanship shall be in accordance with the specifications, standards and codes

which are part of this tender as well as the established engineering practices for this type of work. For any portion of work executed by Contractor and considered defective by EIC, the Contractor shall have to take necessary remedial measures, to the complete satisfaction of EIC, to make the defective good in order at his own cost without any liability to EIC.

51. The Contractor shall be responsible for the proper workmanship and shall not be relieved of his obligation in this regard just because no objection was raised by EIC during the progress of work. The workmanship guarantee period will be of 12 months from the date of final completion as a whole, certified by EIC.
52. The EIC or their representative shall reserve the right to inspect/witness, review any or all stages of work at shop/site as deemed necessary for quality assurance.
53. In case Contractor fails to follow the instructions of Engineer-in-charge with respect to above clauses, next payment due to him shall not be released unless until he complies with the instructions to the full satisfaction of Engineer-in-charge.
54. The Contractor, during entire duration of the Contract, shall adhere to HSE requirement as per Specification.
55. Housekeeping should be maintained and followed at work area during the work and after completion of the work by the contractor.
56. The contractor shall make his own arrangements for site store cum office for shifting of his safe custody of tools and equipment's at site. Open space shall be provided by HURL inside the Township.
57. In case, interpretation of any job is not clear, the decision of Engineer-in-charge shall be final and binding. In case of doubt, contractor shall consult the Engineer-in-charge or Area-In-charge for clarification before the start of work.
58. Wherever specifications are not clear, clarification for the same can be had from the authority concerned before quoting the rate. Reasoning of any ignorance shall not absolve the contractor of his commitment to the execution of job.
59. All materials including tools and tackles and other materials viz. ladders etc. if required are to be shifted by the contractor for jobs to be attended by the contractor for which no extra payment will be made.
60. Wherever supply of material is in the scope of contractor, the same to be duly approved from Engineer-in-charge before its use in any construction activities/installation.
61. If any item is appearing at two or more places or in various sub heads of the contract, the payment to the contractor shall be made on the basis of lowest quoted rates in the contract /under various sub-heads.
62. The contractor shall give details of manpower to be deployed for successful completion of each work at any time to HURL Engineer-in-charge.
63. In case, any worker/supervisor is not acceptable to Engineer-in-Charge on account of his lack of skill/competence or otherwise, he has to be replaced by the contractor with suitable/acceptable hand.
64. HURL shall have power to make any alteration in, omission from, addition to, or substitutions for original specifications and instructions which may be considered necessary, during the progress of work and Contractor shall have to carry out the work in accordance with any instruction which may be given to him in writing duly signed by Engineer-in-charge. Such alteration, omission, additions, substitutions, shall not invalidate the contract and any altered, additional or

substituted work which the Contractor may be directed to do in the manner above specified as a part of the work, shall be carried out by the Contractor on the same condition in all respects on which he has agreed to do the main work.

65. Contractor shall be responsible for necessary health check, permits for workmen, employees deployed for working at height as per norms.
66. The Contractor shall not engage any workman having age below 18 years and having age above 60 years. During the contract period if any contractor's workman attains the age of 60 years, the contractor shall replace such workman with new workman.
67. All tools and tackles required for completion of the jobs shall be in scope of contractor.
68. All tools, plant and materials shall be brought by the Contractor to the works site through a covering note to be submitted in 3 copies. One copy of the covering note will be delivered to the security staff and one copy to the Owner/Consultant. The third copy shall be retained by the Contractor. The Contractor shall follow all rules and regulations for entry / exit of their men and materials in/from project site as framed by Owner/Consultant.

Approved make

12.0 CEMENT

- a) ACC
- b) J K CEMENT
- d) JP CEMENT
- e) GUJARAT AMBUJA
- f) ULTRA TECH CEMENT
- i) SHREE CEMENT

13.0 RCC DESIGN MIX – NABL certified lab

STRUCTURAL STEEL / CS PLATE

- a) SAIL
- b) TATA STEEL
- c) RINL
- d) JINDAL
- e) ESSAR
- f) ISPAT INDUSTRIES

MATERIAL TEST HOUSE- NABL Certified Lab

- #### **CERAMIC TILES**
- b) BELL CERAMICS
 - c) SOMANY CERAMICS
 - d) H&R JOHNSON CERAMICS
 - e) KAJARIA CERAMICS
 - f) ORIENT CERAMICS

WOOD WORK

- #### **FLUSH DOOR**
- a) SITAPUR PLYWOOD
 - b) WOODCRAFT PRODUCTS
 - c) KITPLY PRODUCTS

**PLY WOOD/BLOCK
BOARD**

- a) WOODCRAFT PRODUCTS
- b) KITPLY PRODUCTS
- c) GREEN PLY

**PARTICLE BOARD
(EXTRA GRADE)**

- a) BHUTAN BOARD
- b) BEST BOARD
- c) NOVAPAN INDIA LTD.
- d) THE BOMBAY BURMAN TRADING CORPN. LTD.

**MDF BOARD/MD
PARTICLE BOARD
(EXTRA GRADE)
VENEERED/LAMINATED**

- a) NUCHEM LTD.
- b) MANGALAM TIMBER PRODUCTS LTD.
- c) WESTERN BIO SYSTEMS LTD.

**DECORATIVE
LAMINATES**

- a) THE BOMBAY BURMAN TRADING CORPN. LTD.
- b) GREENPLY INDUS. LTD.
- c) BAKELITE HYLAM LTD.
- d) RAMMICA INDUSTRIES

MARINE PLYWOOD

- a) INDIAN PLYWOOD MFG. CO. LTD.
- b) SWASTIC PLYWOOD

DOORS & WINDOWS FITTINGS

**MORTICE LOCKS
WITH HANDLES**

- a) GODREJ & BOYCE
- b) EVERITE AGENCIES (P) LTD.
- c) GOLDEN INDUSTRIES

**MISC. DOOR
FITTINGS HINGES,
TOWER BOLTS,
LATCHES, SPOPPERS,
STAYS, ALDROPS
ETC.**

- a) EVERITE AGENCIES (P) LTD.
- b) EBCO INDUSTRIES
- c) ECIE (P) LTD.
- d) NU-LITE INDUSTRIES

FASTENERS a) HILTI INDIA PVT. LTD.
b) FISCHER

**STEEL/ ALUMINIUM DOORS, WINDOWS & VENTILATOR
PRESSED STEEL
DOORS WINDOWS &
SECTION DOORS
WINDOWS/ROLLING
SHUTTER**

- a) RAYMUS ENGINEERS
- b) DHIMAN STEEL

- c) RDG ENGINEERING
- d) SUPER STEEL WINDOW CO.
- e) SKS STEEL INDUS.

**ALUMINIUM / DOORS/
WINDOWS SECTIONS**

- a) JINDAL ALUMINIUM LTD.
- b) HINDALCO INDUSTRIES
- c) INDAL

**FIRE-PROOF
DOORS(APPROVED)**

- a) NAVAIR INTERNATIONAL
- b) RDG ENGINEERING

**PVC DOORS /
WINDOWS**

- a) SINTEX Or APPVD EQUIV.
- PVC WATER TANKS a) SINTEX Or APPVD EQUIV.

PLASTERING

- WATERPROOFING/
COMPOUND IN
CEMENT PLASTER
- a) STRUCTURAL WATER PROOFING CO. (P) LTD.
 - b) PIDILITE INDUSTRIES

**PLASTIC EMULSION
INTERIOR/EXTERIOR**

- a) ICI INDIA LTD.
- b) BERGER PAINTS LTD.
- c) ASIAN PAINTS LTD.
- d) SHALIMAR PAINTS
- e) KANSAI NEROLAC

PAINTS LTD.

DRY OILBOUND

DISTEMPER

- a) ASIAN PAINTS LTD.
- b) KANSAI NEROLAC

PAINTS LTD.

INDUSTRIAL /

**EXPOXY/ SYNTHETIC
ENAMEL PAINTS**

- a) ICI/AKZO NOBEL INDIA
- b) BERGER PAINTS LTD.
- c) ASIAN PAINTS LTD.
- d) SHALIMAR PAINTS
- e) INTERNATIONAL MARINE COATINGS PVT. LTD.
- f) KANSAI NEROLAC PAINTS LTD.

- g) BOMBAY PAINT

WATERPROOF

CEMENT PAINT

- a) KILLICK NIXON LTD.
- b) RAJDHOT PAINTS

WOOD MELAMINE

POLISH

- a) ASIAN PAINTS
- b) SHALIMAR PAINTS

WATERPROOFING

TRANSPARENT

EXTERIOR WALL

COATING (OVER

PAINTED SURFACE)

- a) PIDILITE INDUSTRIES
- b) INDUSTRIAL PROD. MFG
- c) STRUCTURAL WATERPROOFING CO.(P) LTD.

FIRE PROOF

COATING

- a) NAVAIR INTERNATIONAL OR APPVD. EQUIV.

SANITARY PLUMBING FITTINGS & FIXTURES

SANITARY FITTINGS

WASH BASIN, URINAL ETC.)

- a) HINDUSTAN SANITARY
WARE & INDUS. LTD.
- b) PARRYWARE SANITARY
WARE
- c) MADHUSUDAN
CERAMICS
- d) NYCER CERAMICS

PLUMBING FITTINGS

FIXTURES

- a) GEM
- b) PARKO
- c) KINGSTON

GLASS/MIRROR

SHEET/ FLOAT/ TOUGHENED/

LAMINATION

- a) GUJARAT GUARDIAN
LTD.
- b) SAINT GOBAIN
- c) ASAH FLOAT

GI PIPES

- a) JINDAL
- b) SURYA
- c) PRAKASH

TIMT BAR / REBAR

- a) SAIL
- b) TATA STEEL
- c) RINL

Technical Specifications

GENERAL

1.1 Specifications of materials and workmanship shall be as described in the Central Public Works Department Specifications Vol. I & II (latest) include latest amendments, unless otherwise specified. These CPWD Specifications shall be deemed to form part of this contract. The CONTRACTOR shall procure and maintain copies of the latest CPWD Specifications at site for reference.

1.2 These technical Specifications shall be supplementary to the specifications contained in the CPWD specifications, wherever at variance, these Particular Specifications shall take precedence over the provisions in the CPWD Specifications.

2.0 REFERENCE CODES & STANDARDS

2.1 Wherever reference of IS Specifications/ or IS Codes of Practice are made in the Specifications/ Schedule of Rates or Preambles, reference shall be to the latest edition of IS (Bureau of Indian Standards).

IS - 383 Coarse & Fine aggregates from natural sources for concrete.

IS - 427 Distemper, dry, colour as required.

IS - 432 Mild Steel & Medium tensile steel bars.

IS - 456 Code of Practice for Plain and Reinforced Concrete.

IS - 515 Natural and Manufactured aggregates for use in mass concrete

IS - 730 Hook bolts for corrugated sheet roofing

IS - 800 Code of Practice for General Construction in Steel

IS - 1079 Hot rolled carbon steel sheets & strips

IS - 1081 Code of practice for fixing and glazing of metal (steel & aluminium) doors, windows and ventilators.

IS - 1161 Steel tubes for structural purposes.

IS - 1285 Wrought aluminium & aluminium alloy extruded round tube and hollow sections

IS - 1361 Steel windows for Industrial Buildings.

IS - 1363 Hexagon head bolts, screws & nuts of product grade C : Part - I
Hexagon head bolts (size range M5 to M64)

IS - 1367 Technical supply conditions for threaded steel fasteners

IS - 1566 Hard - Drawn steel wire fabric for concrete reinforcement.

IS - 1786 High strength deformed steel bars & wires for concrete reinforcement.
 IS - 2062 Steel for general structural purposes.
 IS - 2116 Sand for masonry mortars.
 IS - 2212 Code of practice for brickwork.
 IS - 2386 Methods of test for aggregates.
 IS - 2835 Flat transparent sheet glass
 IS - 4021 Timber door, window and ventilator frames
 IS - 4923 Hollow Steel sections for structural use.
 IS - 4925 Concrete batching and mixing plant.
 IS - 5410 Cement Paint
 IS - 6477 Dimensions for wrought aluminium & aluminium alloys, extruded hollow sections.
 IS - 7318 Fusion welding of steel.
 IS - 10262 Recommended guidelines for concrete mix design.
 IS - 14871 Products in Fibre Reinforced Cement – Long Corrugated or Asymmetrical Section Sheets and Fittings for Roofing and Cladding
 - Specification

3.0 EARTHWORK

3.1 Excavation

3.1.1 Excavation shall be carried out in soil of any nature and consistency, in the presence of water or in the dry, met on the site to the lines, levels and contours shown on the detailed drawings and CONTRACTOR shall remove all excavated materials to soil heaps on site or transport for use in filling on the site or stack them for reuse as directed by the Engineer-in-Charge.

3.1.2 Surface dressing shall be carried out on the entire area occupied by the buildings including plinth protection as directed without any extra cost. The depths of excavation shown on the drawings are the depths after surface dressing.

3.1.3 The site around all buildings and structures to a width of 3 metres beyond the edge of plinth protection, ramps, steps, etc. shall be dressed and sloped away from the buildings.

3.1.4 Black cotton soil, and other expansive or unsuitable soils excavated shall not be used for filling in foundations, and plinths of buildings or in other structures including manholes, septic tanks etc. and shall be disposed off within the contract area marked on the drawings, as directed, levelled and neatly dressed.

3.1.5 In case of trenches exceeding 2 metres depth or where soil is soft or slushy, the sides of trenches shall be protected by timbering and shoring. The CONTRACTOR shall be responsible to take all necessary steps to prevent the sides of trenches from caving in or collapsing. The extent and type of timbering and shoring shall be as directed by the Engineer-in-Charge.

3.1.6 Where the excavation is to be carried out below the foundation level of adjacent structure, the precautions to be taken such as under pinning, shoring and strutting etc. shall be determined by Engineer-in-Charge. No excavation shall be done unless such precautionary measures are carried out as per directions of Engineer-in-Charge.

3.1.7 Specification for Earth work shall also apply to excavation in rock in general. The excavation in rock shall be done such that extra excavation beyond the required width and depth as shown in drawings is not made. If the excavation done in depth greater than required /ordered. The CONTRACTOR shall fill the extra excavation with concrete of mix 1:5:10 as the foundation concrete at his own cost.

3.1.8 CONTRACTOR shall make all necessary arrangements for dewatering / defiling as required to carry out proper excavation work by bailing or pumping out water, which may accumulate in the excavation pit from any cause/ source whatsoever. In addition to this, if required, contractor shall also install continuous dewatering pump-sets to lower the ground water table below the working level to make the area fit and safe for working.

3.1.9 CONTRACTOR shall provide suitable draining arrangements at his own cost to prevent surface water entering the foundation pits from any source.

3.1.10 The CONTRACTOR is forbidden to commence the construction of structures or to carry out concreting before Engineer-in-Charge has inspected, accepted and permitted the excavation bottom.

3.1.11 Excavation in disintegrated rock means rock or Boulders including brickbats which may

be quarried or split with crow bars. This will also include laterite and hard conglomerate.

3.1.12 Excavations in hard rock - meant excavation made in hard rock to be done manually, or by blasting using only explosives and / or pneumatic hammers. In case of blasting, control blasting should be adopted depending on site conditions. For using explosives CONTRACTOR shall follow all provisions of Indian Explosives Act / Rules 1983, corrected / revised up to date.

3.1.13 In case of hard rock excavation to be carried out using explosives the, CONTRACTOR shall obtain the written approval in advance.

3.1.14 The measurements for excavations shall be restricted and limited to minimum excavation line as per drawing for payment purposes.

3.1.15 Adequate protective measures shall be taken to see that the excavation does not affect or damage adjoining structures. The CONTRACTOR shall take all measures required for ensuring stability of the excavation and safety of property and people in the vicinity. The CONTRACTOR shall erect and maintain during progress of work, temporary fences around dangerous excavations at no extra cost.

3.1.16 Excavation in ordinary soil means excavation in ordinary hard soil including stiff heavy clay, hard shale, or compact moorum, or any materials, which can be removed by the ordinary application of spades, shovels, picks and pick axes. This shall also include removal of isolated boulders each having a volume not more than 0.50m³.

3.1.17 Excavation in soft rock includes limestone, sandstone, laterite, hard conglomerates, etc. or other rock which can be quarried or split with crowbars or wedges. This shall also include excavation of tarred pavements, masonry work and rock boulders each having a volume of not more than 0.25m³.

3.1.18 Excavation in hard rock includes any rock bound in ledges or masses in its original form or cement concrete for which in the opinion of the Engineer-in-Charge, requires the use of compressed air, equipment, sledge hammer and blasting or non-explosive materials viz. Acconex manufactured by A.C.C. Ltd. Specifications and instructions for use shall be as per manufacturer.

3.1.19 In case of any difficulty concerning the interpretation of type of soil as mentioned above, the Engineer-in-Charge shall decide whether the excavation in a particular material is in ordinary soil, soft rock or hard rock and his decision in this matter shall be final and binding on the CONTRACTOR and without appeal.

3.2 Filling

3.2.1 Back filling of excavations in trenches, foundations and elsewhere shall consist of one of the following materials approved by Engineer-in-Charge.

Soil

Sand

Moorum

Hard-core

Stone/gravel

All back filling material shall be approved by the Engineer-in-Charge.

3.2.2 Soil filling - Soil material shall be free from rubbish, roots, hard lumps and any other foreign organic material. Filling shall be done in regular horizontal layers each not exceeding 20 cm. depth.

3.2.3 Back filling around completed foundations, structures, trenches and in plinth shall be done to the lines and levels shown on the drawings.

3.2.4 Back filling around pipes in the trench shall be done after hydro testing is done.

3.2.5 Back filling around liquid retaining structures shall be done only after leakage testing is completed and approval of Engineer-in-Charge is obtained.

3.2.6 Sand used for filling under foundation concrete, around foundation and in plinth etc. shall be fine/ coarse, strong, clean, free from dust, organic and deleterious matter. The sand filling under foundation shall be rammed with Mech. compactor. Sand material shall be approved by Engineer-in-Charge.

3.2.7 Moorum for filling, where ordered, shall be obtained from approved pits and quarries which contain siliceous material and natural mixture of clay. Moorum shall not contain any admixture of ordinary earth. Size of moorum shall vary from dust to 10 mm.

3.2.8 Hard-core shall be of broken stone of 90 mm to 10 mm size suitable for providing a dense and compact sub grade. Stones shall be sound, free from flakes, dust and other impurities. Hard core filling shall be spread and levelled in layers, 15 cm thick, watered and well compacted with ramming or with mechanical / hand compacts including hand

packing wherever required.

3.2.9 If any selected fill material is required to be borrowed, CONTRACTOR shall make arrangements and procure such material from outside borrow pits after obtaining all necessary permissions from statutory authorities. The material of source shall be subject to prior approval of Engineer-in-Charge. CONTRACTOR shall make necessary access roads to borrow areas and maintain the same, if such access roads do not exist, at no extra cost.

3.2.10 Plinth filling shall be carried out with approved material as described earlier, in layers not exceeding 150mm, watered and compacted with mechanical compaction machines. Engineer-in-Charge may however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When

filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at later stage. The finished level of the filling shall be trimmed to the level specified. Compacted surface shall have at least 95% of laboratory maximum dry density. A minimum of one test per 250 sq. meters of compacted area shall be done.

3.2.11 Whenever the fill material (earth or soil) is purchased, CONTRACTOR shall get the approval of Engineer-in-Charge. The CONTRACTOR shall arrange to determine the following properties of the soil (at outside NABL accredited laboratory without any cost to owner) and shall get the approval of Engineer-in-Charge.

1. Clay content : 15% to 20%

2. Laboratory dry density (MDD)

: Not less than 1600 kg/m³

3. Plasticity Index : Not more than 20

4. Optimum Moisture Content (OMC)

: 8% to 12%

3.2.12 The fill shall be compacted using a vibrating compactor of not less than 1.5 tonne. The fill shall be thoroughly compacted in layers as directed but not more than 200 mm thick. Adequate water shall be used for compaction and the density after compaction shall be not less than maximum dry density obtained in test of IS: 2720 Part-8. Compacted surface shall have at least 95% of laboratory maximum dry density. A minimum of one test per 250 sq. meters of compacted area shall be done for each layer.

3.2.13 The Gravel fill shall be non plastic granular material, well graded, strong, with maximum particle size of 50 mm, with not more than 15% passing a 4.75 mm IS sieve, free of all debris, vegetable matter and chemical impurities.

3.2.14 All clods, lumps etc. shall be broken before compaction.

3.2.15 In case of grading/banking successive layers of filling shall not be placed, until the layer below has been thoroughly compacted to satisfy the requirements laid down in this specification.

Prior to rolling, the moisture content of material shall be brought to within +/-2% of the optimum moisture content as described in IS 2720 Part-7. The moisture content shall preferably be on the wet side for potentially expansive soil.

After adjusting the moisture content as described, the layers shall be thoroughly compacted by means approved by Engineer-in-Charge, till the specified maximum laboratory dry density is obtained.

General, fill shall be placed in layers not exceeding 300 mm thickness and shall be thoroughly compacted to achieve a compaction of at least 95% of laboratory maximum dry density up to a depth of 600 mm below finished grade. Final fill of 600 mm thickness shall consist of preferably natural material in, as dug condition except that stones larger than 100 mm shall be removed. It shall be placed in layers not exceeding 150 mm thickness and compacted to achieve of at least 95% of laboratory maximum dry density. Each layer shall be tested in field for density and accepted by Engineer-in-Charge, subject to achieving the required density before laying the next layer. A minimum of one test per 250 sq meters for each layer shall be conducted. If the layer fails to meet the required density, it shall be reworked or the material shall

be replaced and method of construction altered as directed by Engineer-in-Charge to obtain the required density.

The filling shall be finished in conformity with the alignment, levels, cross-section and dimensions as shown in the drawing.

Extra material shall be removed and disposed off as directed by the Engineer-in-Charge.

4.0 PLAIN AND REINFORCED CONCRETE WORK

This specifications deals with cement concrete, plain or reinforced, for general use, and covers the requirements for concrete materials, their storage, grading, mix design, strength & quality requirements, pouring at all levels, reinforcements, protection, curing, form work, finishing, painting, admixtures, inserts and other miscellaneous works.

4.1 Materials

4.1.1 Cement: Any of the following cements may be used as required.

4.1.2 Water: Water used for mixing and curing concrete and mortar shall conform to the requirements as laid down in IS: 456. Sea water shall not be used for concrete work.

4.1.3 Aggregates: Coarse and fine aggregates for cement concrete plain and reinforced shall conform to the requirements of IS 383 and / or IS 515. Before using, the aggregates shall be tested (at outside NABL accredited laboratory without any cost to owner) as per IS: 2386.

Coarse aggregate: Coarse aggregate for all cement concrete work shall be broken or crushed hard stone, black trap stone obtained from approved Quarries or gravel.

Sand: Fine aggregate for concrete work shall be coarse sand from approved sources.

Grading of coarse sand shall be within grading zones I, II or III laid down in IS: 383, table 4. If required the aggregates (both fine and coarse) shall have to be thoroughly washed and graded as per direction of Engineer-in-Charge.

4.2 Mixing

All cement concrete plain or reinforced shall be machine mixed. Mixing by hand may be employed where quantity of concrete involved is small, with the specific prior permission of the Engineer-in-Charge. 10% extra cement shall be added in case of hand mixing as stipulated in IS-456.

For large and medium project sites the concrete shall be sourced from ready- mixed concrete plants or from on site or off site batching and mixing plants (IS 4926)

4.3 Water Cement Ratio, Laying & Curing

Water Cement Ratio, Laying & Curing shall be done as per IS:456.

4.4 Grades of Concrete

4.4.1 Grades lower than M 25 shall not be used in reinforced concrete.

4.4.2 A sieve analysis test of aggregates shall be carried out (at outside NABL accredited laboratory without any cost to owner) as and when the source of supply is changed without extra charge notwithstanding the mandatory test required to be carried out as per CPWD specification.

4.4.5 All tests in support of mix design shall be maintained as a part of records of the contract. Test cubes for mix design shall be prepared by the CONTRACTOR under his own arrangements and at his costs, but under the supervision of the Engineer-in-Charge.

4.5 Design Mix Concrete

4.5.1 Design mix shall be allowed for major works where it is contemplated to be used by installing weigh batch mixing plant as per IS 4925. At the time of tendering, the CONTRACTOR, after taking into account the type of aggregates, plant and method of laying he intends to use, shall allow in his tender for the design mix i.e., aggregate/cement and water/cement ratios which he considers will achieve the strength requirements specified, and workability for concrete to be properly finished.

4.5.2 Before commencement of concreting, CONTRACTOR shall carry out preliminary tests (at outside NABL accredited laboratory without any cost to owner) for design mix on trial mixes proposed by him in design of mix to satisfy the Engineer-in-Charge that the characteristic strength is obtained. In this regard, CONTRACTOR may consult govt. approved/reputed institute to get design mix done as per IS 10262 at his own cost. The concrete mix to be actually used shall be approved by the Engineer-in-Charge.

4.5.3 Notwithstanding the above, the following shall be the maximum combined weight of coarse and fine aggregate per 50 kg of cement.

Grade of Concrete Maximum weight of fine & coarse aggregates together per 50 kg of cement

(for nominal mix only)

1. M - 10 480 kg
2. M - 15 350 kg
3. M - 20 250 kg

4.5.4 The workability of concrete produced shall be adequate, so that the concrete can be properly placed and compacted. The slump shall be as per IS 456.

4.6 Testing of Concrete

4.6.1 Testing of concrete, sampling and acceptance criteria shall be in accordance with IS 456.

4.7 Proportioning

Mixes of cement concrete shall be as ordered. Where the concrete is specified by grade, it shall be prepared by mixing cement, sand and coarse aggregate by weight as per mix design. In case the concrete is specified as volumetric mix, then dry volume batching shall be done, making proper allowances for dampness in aggregates and bulking in sand. Equivalent volume batching for concrete specified by grade may however be allowed by the Engineer-in-Charge at his discretion.

4.8 Pre Cast Concrete

The specifications for pre cast concrete will be similar as for the cast in situ concrete. All pre cast work shall be carried out in a yard made for the purpose. This yard shall be dry, properly levelled and having a hard and even surface. If the ground is to be used as a soft former of the units, shall be paved with concrete or masonry and provided with a layer of plaster (1:2 proportion) with smooth neat cement finish or a layer of MS sheeting. The casting shall be over suitable vibrating tables or by using form vibrators as per directions of Engineer-in-Charge.

The yard, lifting equipment, curing tank, finished material storage space etc. shall be designed such that the units are not lifted from the mould before 7 (seven) days of curing and can be removed for erection after 28 (Twenty Eight) days of curing. The moulds shall preferably be of steel or of timber lined with G.I. sheet metal. The yard shall preferably be fenced.

Lifting hooks, wherever necessary or as directed by Engineer-in-Charge shall be embedded in correct position of the units to facilitate erection, even though they may not be shown on the drgs. and shall be burnt off and finished after erection.

Pre cast concrete units, when ready shall be transported to site by suitable means approved by Engineer-in-Charge. Care shall be taken to ensure that no damage occurs during transportation. All adjustments, levelling and plumbing shall be done as per the instructions of the Engineer-in-Charge. The CONTRACTOR shall render all help with instruments, materials and staff to the Engineer-in-Charge for checking the proper erection of the pre cast units.

After erection and alignment the joints shall be filled with grout or concrete as directed by Engineer-in-Charge. If shuttering has to be used for supporting the pre cast unit they shall not be removed until the joints has attained sufficient strength and in no case before 14 (fourteen) days. The joint between pre cast roof planks shall be pointed with 1:2 (1 cement : 2 sand) mortar.

5.0 STEEL REINFORCEMENT

5.1 Steel reinforcement shall comprise:

Mild steel bars conforming to IS : 432 Part-I.

Cold twisted bars conforming to IS: 1786

CRS bars

TMT bars

Hard drawn steel wire fabric conforming to IS: 1566

5.2 All joints in reinforcement shall be lapped adequately to develop the full strength of the reinforcement as per provision of IS: 456 or as per instruction of Engineer-in-Charge.

6.0 FORM WORK

6.1 The shuttering or form work shall conform to the shape, lines and dimensions as shown on the drawings and be so constructed as to remain sufficiently rigid during placing and compacting of the concrete and shall be sufficiently tight to prevent loss of liquid from the concrete. The surface that becomes exposed on the removal of forms shall be examined by Engineer-in-Charge or his authorized representative before any defects are made good. Work that has sagged or bulged out, or contains honey combing, shall be rejected. All shuttering shall be plywood or steel shuttering.

6.2 The CONTRACTOR shall be responsible for sufficiency and adequacy of all form work. Centering and form work shall be designed & detailed in accordance with IS 14687 and approved by the Engineer-in-Charge, before placing of reinforcement and concreting.

6.3 Stripping Time

Forms shall not be struck until the concrete has reached strength at least twice the stress to which the concrete may be subjected at the time of removal of form work. The strength referred to shall be that of concrete using the same cement and aggregates, with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work. Where possible, the form work shall be left longer as it would assist the curing.

Note 1: In normal circumstances and where ordinary Portland Cement is used, forms may generally be removed after the expiry of the following periods:

1. Walls, columns and vertical faces of all structural members

24 to 48 hours as may be decided by the Engineer-in-Charge

2. Slabs (props left under) 3 days

3. Beam soffits (Props left under) 7 days

4. Removal of props under slabs

1. Spanning up to 4.5 m 7 days

2. Spanning over 4.5 m 14 days

5. Removal of props under beams & arches:

1. Spanning up to 6 m 14 days

2. Spanning over 6m 21 days

For other types of cements, the stripping time recommended for ordinary Portland Cement may be suitably modified.

Note 2: The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab, beam or arch as the case may be together with any live load likely to occur during curing or further construction.

7.0 CEMENT CONCRETE BLOCK

Cement concrete block shall be machined made in the proportion of such that mix shall not be leaner than one cement to twelve combined aggregates (by volume) but having minimum strength of 7.5 MPa. Combined aggregate shall be graded as near as possible to IS: 383. The fineness modulus of combined aggregate shall be between 3.6 and 4. The concrete block shall be properly cured as per IS-456. The surface of conc. block shall have even face without any honeycomb and free from cracks.

7.1 Mortar

Cement and water shall conform to the requirements laid down for cement concrete work.

7.1.1 Sand for concrete block masonry mortars shall be coarse sand generally conforming to IS: 2116. Maximum quantities of clay, fine dust, shall not be more than 5% by weight. Organic impurities shall not exceed the limits laid down in IS: 2116.

7.1.2 Mix of mortar for building concrete block shall be as specified in the item of work.

7.1.3 Mixing of the mortar shall be done in a mechanical mixer. When quantity involved is small hand mixing may be permitted by Engineer-in-Charge. Any mortar remaining unused for more than 30 minutes after mixing shall be rejected.

7.2 Concrete Block Masonry

The thickness of joints shall be 10 mm +/- 3mm. Thickness of joints shall be kept uniform. In case of foundation and manholes etc. joints up to 15 mm may be accepted.

7.3 Half Concrete Block

All courses shall be laid with stretchers. Reinforcement comprising 2 nos. 6 mm dia MS bars shall be provided over the top of the first course and thereafter at every fourth course.

7.4 Fixtures

All iron fixtures, pipes spouts, hold fasts of doors and windows which are required to be built into the wall shall be embedded in cement concrete blocks 1:2:4 mix (1 cement :2 coarse sand :4 graded stone aggregate. 20 mm nominal size) of size indicated in the item.

7.5 Curing

Concrete block masonry shall be protected from rain by suitable covering when mortar is green. Masonry work shall be kept constantly moist on all faces for a minimum period of seven days.

8.0 STRUCTURAL STEEL WORK

This specification covers the technical requirements for the preparation of shop drawings, supply, fabrication, protective coating, painting and erection of all structural steel rolled sections, built up sections, plates and miscellaneous steel required for the completion of the work.

Steel

All structural steel used in construction within the purview of this contract shall, comply with one of the following Bureau of Indian Standard Specifications, whichever, is appropriate or as specified.

IS – 2062 Hot rolled sections and plates

IS – 1079 Cold formed light gauge sections

IS – 1161 Tubular sections

IS – 4923 Hollow sections (rectangular or square)

Fabrication

Fabrication of steel structure shall be carried out in conformity with the best modern practices and with due regard to speed with economy in fabrication and erection and shall conform to IS-800. All members shall be so fabricated as to assemble the members accurately on site and erect them in correct positions. Before dispatch to site the components shall be assembled at shop and any defect found rectified. All members shall be free from kink, twist, buckle, bend, open joints etc. and shall be rectified before erecting in position. Failure in this respect will subject the defective members to rejection.

MS Black/High Strength Bolts and Nuts

M.S.Black or high strength bolts, nuts and washers etc. shall be as per IS-800, IS-1363 and IS-1367. Manufacturer's test certificate shall be made available to the Engineer-in-Charge. For bolted joints, shanks and threaded bolts are to be used to ensure that threaded length do not encroach within the thickness of connected members of dimension beyond the following limit:-

1. 1.5 mm for connected members of thickness below 12 mm and
2. 2.5 mm for connected member of thickness 12 mm and above and that adequate shearing and bearing values required as per design are achieved.

Every portion work shall have its erection mark or numbers stencilled on the member for guidance in erection and bear all necessary marks of erections as directed by the Owner / Consultant.

8.2 No part of the work is to be oiled, painted (except contact surfaces) packed, bundled, crated or dispatched until it has been finally inspected and approved by the Owner / Consultant or his authorized representative. The whole steel work before being dispatched from the Contractor's shop shall be dry and after being thoroughly cleaned from dust, mills scale, rust etc., and shall be given two coats of primer and one coat of final paint as per painting specification attached in this enquiry. Unless otherwise specified, all surfaces inaccessible after welding shall be given two coats of primer and two coats of paints as per painting specification attached in this enquiry.

8.3 The Owner / Consultant or his authorized representative shall have free access at all reasonable time to all places where the work is being carried out, and shall be provided by the Contractor at his own expenses all necessary facilities for inspection during fabrication and erection. The Owner / Consultant or his authorized representative shall be at liberty to reject the work in whole or in part if the workmanship or materials do not conform to the terms of the specifications mentioned herein. The Contractor shall remove, replace or alter any part of the work as ordered by the Owner / Consultant or his authorized representative.

9.0 PAINTING ON STRUCTURAL STEEL

The following specification shall be used for painting of structural steel work.

9.1 Scope

This specification covers the technical requirements for shop and site application of paint and protective coatings and includes; the surface preparation, priming, application, testing and quality assurance for protective coatings of structural steelwork, plate work, handrails and associated metal surfaces, which will be

exposed to atmospheric for industrial plants.

9.2 Definitions

C.S - Carbon steel and low chrome (1-1/4 Cr through 9 Cr) alloys

S.S - Stainless steel, such as 304,316, 321, 347,

Non-ferrous - copper, aluminium and their alloys.

High Alloy - Monel, Inconel, Incoloy, Alloy 20, Hastelloy, etc.

DF - Dry Film thickness, the thickness of the dried or cured paint or coating film.

9.3 Safety Regulations

Protective coatings and their application shall comply with all national, state, and local codes and regulations on surface preparation, coating application, storage, handling, safety, and environmental recommendations.

Sand or other materials producing silica dust shall NOT be used for any open-air blasting operations.

9.4 Material Safety Data Sheets

The latest issue of the coating manufacturer's product datasheet, application instructions, and material safety data Sheets shall be available prior to starting the work and shall be complied with during all preparation and painting / coating operations.

9.5 Materials

All paints and paint materials shall be obtained from the company's approved manufacturer's list. All materials shall be supplied in the manufacturer's containers, durably and legibly marked as follows.

Specification number

Colour reference number

Method of application

Batch number

Date of Manufacture

Shelf life expiry date

Manufacturer's name or recognised trade mark.

9.6 CODE AND STANDARDS:

Without prejudice to the provision of Clause 1.1 above and the detailed specifications of the contract, the following codes & standards shall be followed. Wherever reference to any code is made, it shall correspond to the latest edition of the code.

9.7 Indian Standards:

IS-5: 1994 Colors for ready mixed paints and enamels.

IS-2379: 1990 Color codes for identification of pipe lines.

IS-2629: 1985 Recommended practice for hot-dip galvanizing on iron and steel.

IS-2633: 1986 Methods for testing uniformity of coating of zinc-coated articles.

IS-8629: 1977 Code of practice for protection of iron and steel structures from atmospheric corrosion.

IS: 110 Specification for Ready Mixed Paint, Brushing, Grey Filler, for Enamels, for Over Primers

IS: 101 Methods of test for ready mixed paints & enamels.

9.8 Other Standards:

9.8.1 Swedish Standard: SIS-05 5900-1967 / ISO-8501-1-1988

(Surface preparations standards for Painting Steel Surface).

This standard contains photographs of the various standards on four different degrees of rusted steel and as such is preferable for inspection purpose by the Engineer-in-charge.

9.8.2 DIN: 53151 Standards for Adhesion test.

9.9 The paint manufacturer's, instructions shall be followed as far as practicable at all times. Particular attention shall be paid to the following:

a. Instructions for storage to avoid exposure as well as extremes of temperature.

b. Surface preparation prior to painting.

c. Mixing and thinning.

d. Application of paints and the recommended limit on time intervals between coats.

9.10 Surface Preparation

9.10.1 Safety

All work in adjacent areas, which may negatively affect the quality of blast cleaning, and/or impose safety hazards, must be completed or stopped before the blasting operation starts.

9.10.2 Pre-Cleaning

Prior to surface preparation all weld spatter shall be removed from the surface, all sharp edges ground down and all surfaces cleaned free of contaminants including chalked paint, dust, grease, oil, chemicals and salt. All shop primed surfaces shall be water washed by means of suitable solvent, by steam cleaning, with an alkaline cleaning agent if necessary or by high-pressure water, to remove contaminants prior to top-coating.

9.10.3 Surface decontamination

Surface decontamination shall be performed prior to paint application when uncoated surface is exposed to a corrosive environment or existing paint work is to be repaired. Existing coatings shall be removed by abrasive blast cleaning, and then high pressure potable water shall be used to clean steel surfaces. Prior to application of coatings, the surface shall be chemically checked for the presence of contaminants. A surface contamination analysis test kit shall be used to measure the levels of chlorides, iron salts and pH in accordance with the kit manufacturer's recommendations.

Swabs taken from the steel surface, using cotton wool test swabs soaked in distilled water shall not be less than one swab for every 25m² of surface area to be painted.

Maximum allowable contaminant levels and pH range is as follows:

Sodium chloride, less than 50 microgram / cm²;

Soluble iron salts, less than 7 microgram / cm²; and

pH between 6 – 8

If the results of the contamination test fall outside the acceptable limits, then the wash water process shall be repeated over the entire surface to be painted, until the contaminant test is within the specified levels.

9.10.4 Abrasive blasting

All C.S materials shall be abrasive blast cleaned in accordance with relevant IS Codes.

To reduce the possibility of contaminating S.S., blasting is not usually specified.

However, for coatings which require a blast-cleaned surface for proper adhesion, S.S. may be blast cleaned using clean aluminium oxide or garnet abrasives (Free from any chloride or Iron / Steel contamination). When hand or power tool cleaning is required on

13.0 PLASTERING

13.1 Sand for plastering shall be 50% fine sand and 50% coarse sand from approved sources.

13.2 Preparation of surface shall be done as per CPWD specifications.

13.3 Cement mortar shall be of the mix as indicated in the items and shall be mixed as specified in the CPWD specifications.

13.4 Joints in walls etc. shall be raked to a depth of 12 mm, brushed clean with wire brushes dusted and thoroughly washed before starting the plaster work.

13.5 The surface shall be thoroughly washed with water cleaned and kept wet to saturation point before plastering is commenced.

13.6 Cement mortar as indicated, shall be firmly applied to the masonry walls in a uniform layer to the thickness specified and will be pressed into the joints. On concrete surfaces rendering shall be dashed to the roughened surface to ensure adequate bond. The surface shall be finished even and smooth. Hectoring wherever required shall be done as per directions of Engineer-in-Charge. Nothing extra shall be paid on this account.

13.7 All plaster work shall be cured for at least 7 days.

13.8 Integral water proofing compound shall be mixed with cement in the proportion recommended by the manufacturer. Care shall be taken to ensure that the water proofing material gets well and integrally mixed with cement. All other operations are the same as for general plaster work.

13.9 For sand face plaster undercoat of cement plaster 1:4 (1 cement : 4 sand) of thickness not less than 12 mm shall be applied similar to one coat plaster work. Before the under coat hardens the surface shall be scared to provide for the top coat. The top coat also of cement mortar 1:4 shall be applied to a thickness not less than 8 mm and brought to an even surface with a wooden float. The surface shall then be tapped gently with a

wooden float lined with cork to retain a coarse surface texture, care being taken that the tapping is even and uniform.

14.0 EXTERIOR PAINTING

14.1 Exterior painting shall be Acrylic smooth exterior.

14.2 Where shown on drawings for external surfaces of sand faced plaster, or any other surface, two coats of cement paint shall be applied of tint and shade as approved by the Engineer-in-Charge.

14.3 The surfaces shall be prepared as specified for white washing. Before applying cement paint the surface shall be thoroughly wetted to control surface suction. The surface shall be moist but not dripping wet, when the paint is applied. Not less than 24 hours shall be allowed between the two coats. In hot weather the first coat shall be slightly moistened before applying the second coat.

14.4 On external plastered surfaces (one coat primer + minimum 3 coat of paints), sand faced or plain plastered and concrete surfaces, apex weather proof paint shall be vigorously scrubbed on to work the paint into the voids and provide a continuous paint film free from pin holes and other openings

15.0 GLAZING

15.1 Sheet glass glazing of doors, windows etc. shall be of selected quality glass conforming to IS: 2835. Toughened splinter proof industrial safety glass shall conform to IS: 2553.

No cracked chipped or disfigured glass shall be accepted Glass shall be in one piece for each pan.

15.2 Glazing shall be fixed with timber or steel / aluminium beading as called for. Glass shall be back puttied and fixed with beading for a water tight and rattle free installation. Sizes of timber/ steel / aluminium beading shall be as directed.

Technical Specifications

LIGHTNING ARRESTER

1.1. General

The lightning arresters shall conform in general to IEC-60099-1 or IEC-60099-4 except to the extent explicitly modified in the specification.

The bidder shall offer lightning arresters of gapless type without any series or shunt gap.

Arresters shall be hermetically sealed units, of self-supporting construction, suitable for mounting on structures.

2 Duty Requirements

The lightning arresters shall be of heavy-duty station class type.

The lightning arresters shall be capable of discharging over voltage occurring during switching of unloaded transformers and reactors.

Lightning arresters shall be capable of spark over on severe switching lightnings and multiple strokes.

The lightning arresters shall be able to withstand wind load calculated at 195 kg/sq.m. The gapless arrester, if provided, shall meet following additional requirements.

It shall be fully stabilized thermally to give a life expectancy of 100 years under site conditions and shall take care of the effect of direct solar radiation.

The reference current of the arrester shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage.

3 Constructional Features

The features and constructional details of lightning arresters shall be in accordance with requirement stipulated hereunder:

Gapless Type Lightning Arrester

The nonlinear blocks shall be of sintered metal oxide material. These shall be provided in such a way to obtain robust construction, with excellent electrical and mechanical properties even after repeated operations. The lightning arresters shall be fitted with pressure relief devices and arc diverting parts suitable for preventing shattering of porcelain housing and providing path for flow of rated fault currents in the event of arrester failure.

The arresters shall incorporate anti-contamination feature to prevent arrester failure consequent to uneven voltage gradient across the stack in the event of contamination of the arrester porcelain.

Seals shall be provided in such a way that these are always effectively maintained even when discharging rated lightning current.

Outer insulator shall be porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfection that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Glazing of porcelain shall be of uniform brown colour, free from blisters, burrs and other similar defects. Porcelain housing shall be so coordinated that external flashover will not occur due to application of any impulse or switching lightning voltage up to the maximum design value for arrester.

The end fittings shall be made of non-magnetic and corrosion proof material.

The name plate shall conform to the requirement of IEC incorporating the year of manufacture.

The arrester shall be supplied with suitable support structure either of tubular GI pipe or lattice steel galvanized.

The heat treatment cycle details along with necessary quality checks used for individual blocks along with insulation layer formed across each block to be furnished. Metalized coating thickness for reduced resistance between adjacent discs to be furnished along with procedure for checking the same. Details of thermal stability test for uniform current distribution of current on individual disc to be furnished.

Each arrester shall be complete with insulating base, support structure and terminal connector.

The height of the support structure shall not be less than 2500 mm. The structure would be made of galvanized steel generally conforming to IS:802. The lightning arrester can also be mounted on the neutral grounding reactor in lieu of separate support structure.

Self-contained discharge counter, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation, shall be provided for each unit. The counter shall be visible through an inspection window from ground level. The counter terminals shall be robust and of adequate size and shall be so located that incoming and outgoing connections are made with minimum possible bends.

Suitable milli ammeter on each arrester with appropriate connections shall be supplied to measure the resistor grading leakage current. The push buttons shall be mounted such that it can be operated from ground level.

Discharge counter and milli ammeter shall be suitable for mounting on support structure of the arrester. Grading/Corona rings shall be provided on each complete arrester unit as required for proper stress distribution.

4 Test

4.1 The lightning arresters shall conform to type tests and shall be subjected to routine tests as per IEC-60099.1/IEC-60099.4.

Lightning arrester shall be subjected to additional acceptance tests.

- (i) Construction check (visual check)
- (ii) Measurement of insulation resistance by 1kV megger.

5.1 Gapless Lightning Arrester

Rated arrester voltage	120 kV
Rated system voltage	145 kV
Rated system frequency	50Hz
System neutral earthing	Effectively earthed
Installation	Outdoor
Nominal discharge current	10kA of 8/20 micro sec wave.
Class of arrester	10kA heavy duty type
Minimum discharge capacity	3.5 kJ/kV (referred to rated voltage)
Continuous operating voltage at 50°	102kV
Maximum switching lightning residual voltage (1kA)	280kVp
Maximum residual voltage at	
(i) 5kA	320kVp
(ii) 10kA nominal discharge current	340kVp
Long duration discharge class	2
High current short duration test value (4/10microsec. wave)	100kAp

Current for pressure relief test	40kArms
Low current long duration test value (2000microsec.)	1000Apeak
Min. total creepage distance.	3625 mm.
One minute dry power frequency withstand voltage of arrester housing.	275kVrms
Impulse withstand voltage of arrester housing with 1.2/50 microsec. Wave	+650KVp
Pressure relief class	A
RIV at 92 kVrms.	Less than 500microvolts
Partial discharge at 1.05 continuous over voltage	Not more than 50pC
Seismic acceleration	0.3 g horizontal
0.3 g horizontal.	50 deg C
Reference ambient temperature	

INSTRUMENT TRANSFORMER

INSTRUMENT TRANSFORMERS

GENERAL :

The instrument transformers and accessories shall conform to the latest version of the standards specified below except to the extent explicitly modified in the specification and shall be in accordance with the requirements in specification and as per following IEC/ISS:

Current transformers IEC:44-1 (or IS:2705)

Voltage transformers IEC:186/358 (or IS:3156)

The instrument transformers shall be complete with its terminal box and a common marshalling box for a set of 3 instrument transformers.

The instrument transformer tank along with top metallic shall be hot dip galvanized.

The impregnation details along with tests/checks to ensure successful completion of impregnation cycle shall be furnished for approval.

The instrument transformers shall be designed for use in geographic and meteorological conditions as given in specification.

CONSTRUCTION FEATURES :

The features and constructional details of instrument transformers shall be in accordance with requirements stipulated hereunder :

Bushing/Insulators:

- a) Instrument transformers shall be of 145 kV class, oil filled/SF₆ gas filled, with shedded porcelain/composite bushings/Insulators suitable for outdoor service and upright mounting on steel structures.
- b) Bushings/Insulators shall conform to requirements stipulated in specification. The bushing/insulator for CT shall be one piece without any metallic flange joint.
- c) Bushings shall be provided with oil filling and drain plugs, oil sight glass of CT and for electromagnetic unit of CVT, etc. The bushing/insulator of instrument transformer shall have a cantilever strength of not less than 350 kg for 145 kV Instrument transformers or as per the value obtained vide Chapter- GTR, whichever is higher. Oil filling and drain plugs are not required with SF₆ gas filled CT.

- d) Instruments transformers shall be hermetically sealed units. Bidder/ Manufacturer shall furnish details of the arrangements made for the sealing of instrument transformers along with the bid.

Bidder/Manufacturer shall also furnish the details of site tests to check the effectiveness of hermetic sealing for approval.

- e) Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

Terminal box/Marshalling box :

Terminal box shall conform to the requirements of specification.

Insulating Oil :

- a) Insulating oil to be used for instrument transformers shall be of EHV grade and shall conform to IS: 335 (required for first filling).
- b) The SF₆ gas shall comply with IEC-60376, 60376A and 60376B and shall be suitable in all respects for use in the switchgear under operating conditions.

Name Plate :

Name plate shall conform to the requirements of IEC incorporating the year of manufacture. The rated current, extended current rating in case of current transformers and rated voltage, voltage factor in case of voltage transformers shall be clearly indicated on the name plate. The rated thermal current in case of CT shall also be marked on the name plate.

The intermediate voltage in case of capacitor voltage transformer shall be indicated on the name plate.

CURRENT TRANSFORMERS :

- a) Current transformers shall have single primary either ring type, or hair pin type and suitably designed for bringing out the secondary terminals in a weather proof (IP 55) terminal box at the bottom. These secondary terminals shall be terminated to stud type non disconnecting terminal blocks inside the terminal box. In case "Bar primary" inverted type current transformers are offered the manufacturer will meet following additional requirements:
 - (i) The secondaries shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution.
 - (ii) The lowest part of the insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.

- (iii) The upper part of insulation assembly resting on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly & top dome.
- (iv) Nitrogen if used for hermetic sealing (in case of live tank design) should not come in direct contact with oil.
- (v) Bidder/Manufacturer shall recommend whether any special storage facility is required for spare CT.
- b) Different ratios specified shall be achieved by secondary taps only and primary reconnection shall not be accepted.
- c) Core lamination shall be of cold rolled grain-oriented silicon steel or other equivalent alloys. The cores used for protection shall produce undistorted secondary current under transient conditions at all ratios with specified CT parameters.
- d) The expansion chamber at the top of the porcelain insulators should be suitable for expansion of oil.
- e) Facilities shall be provided at terminal blocks in the marshalling box for star delta formation, short circuiting and grounding of CT secondary terminals.
- f) Current transformer's guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
- g) For 145 kV class CTs, the rated extended primary current shall be 120% (or 150% if applicable) on all cores of the CTs as specified in the specification.
- h) For 145 kV current transformer, characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% to 100% of rated burden over a range of 10% to 100% of rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs.
- i) The current transformer shall be suitable for horizontal transportation. It shall be ensured that the CT is able to withstand all the stresses imposed on it while transporting and there shall be no damage in transit the Contractor shall submit the details of packing design to the Purchaser for review.
- j) For 145 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired up to the terminal blocks.
- k) The wiring diagram plate for the interconnections of the three single phase CTs shall be provided inside the marshalling box. The Bidder/Manufacturer shall strictly adhere to it and deviations, if any, in this regard shall be brought out with justification for Purchaser's review.

- l) The current transformers should be suitable for mounting on lattice support structure to be provided by the Contractor in accordance with stipulations of specification.
- m) The CT shall be designed as to achieve the minimum risks of explosion in service. Bidder/Manufacturer shall bring out in his offer, the measures taken to achieve this.
- n) 145 kV current transformers shall be suitable for high speed auto reclosing.

VOLTAGE TRANSFORMERS :

- a) 145 kV Voltage transformers shall be capacitor voltage divider type with electromagnetic units and shall be suitable for carrier coupling.
- b) Voltage transformers secondaries shall be protected by HRC cartridge type fuses for all the windings. In addition, fuses shall be provided for the protection and metering windings for fuse monitoring scheme. The secondary terminals of the CVTs shall be terminated to the stud type non - disconnecting terminal blocks in the individual phase secondary boxes via the fuse.
- c) CVTs shall be suitable for high frequency (HF) coupling required for power line carrier communication. Carrier signal must be prevented from flowing into potential transformer (EMU) circuit by means of a RF choke/reactor suitable for effectively blocking the carrier signals over the entire carrier frequency range i.e. 40 to 500 KHz. Details of the arrangement shall be furnished along with the bid. H.F. terminal of the CVT shall be brought out through a suitable bushing and shall be easily accessible for connection to the coupling filters of the carrier communication equipment, when utilized. Further earthing link with fastener to be provided for HF terminal.
- d) The electromagnetic unit comprising compensating reactor, intermediate transformer and protective and damping devices should have separate terminal box with all the secondary terminals brought out.
- e) The damping device which should be permanently connected to one of the secondary windings, should be capable of suppressing the ferro resonance oscillations.
- f) The accuracy of 0.2 on secondary III should be maintained throughout the entire burden range up to 50 VA for 145 kV CVTs on all the windings without any adjustments during operation.
- g) 145 kV CVTs shall be suitable for mounting on tubular GI pipe in accordance with stipulations of specification or approved by HURL.
- h) It should be ensured that access to secondary terminals is without any danger of access to high voltage circuit.
- i) A protective surge arrester shall be provided to prevent breakdown of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor/primary winding, tuning reactor/RF choke etc. due to short circuit in transformer secondaries. In case of an alternate arrangement, bidder shall bring out the details in the bid.

- j) The wiring diagram for the interconnection of the three single phase CVTs shall be provided inside the marshalling box in such a manner that it does not deteriorate with time. The Bidder/Manufacturer shall strictly adhere to it and deviations, if any, in this regard shall be brought out with justification for Purchaser's review.

5.0 TERMINAL CONNECTORS :

The terminal connectors shall meet the requirements as given in specification.

TESTS :

In accordance with the requirements in specification, Current and Voltage Transformers should have been type tested and shall be subjected to routine tests in accordance with IEC:44-1/IS:2705 and IEC:186/IS:3156 respectively.

The test reports of the type tests and the following additional type tests shall also be submitted for the Purchaser's review.

a) Current transformers :

- i) Radio interference test as per Annexure-A of specification.
- ii) Seismic withstand test as per Annexure-B of specification.
- iii) Thermal stability test, i.e. application of rated voltage and rated extended thermal current simultaneously by synthetic test circuit.
- iv) Thermal co-efficient test i.e. measurement of tan delta as a function of temperature (at ambient and between 80 C & 90 C) and voltage (at 0.3, 0.7, 1.0 and 1.1 $U_m/\sqrt{3}$)
- v) The current transformer shall be subjected to Fast Transient test by any one of the following two methods given below to assess the CT performance in service to withstand the high frequency over voltage generated due to closing & opening operation of isolators. Alternatively, method as per IEC:44-1 may be followed:

Method I: 600 negative polarity lightning impulses chopped on crest will be applied to current transformer. The opposite polarity amplitude must be limited to 50% of crest value when the wave is chopped. Impulse crest values will be 1000 kVp for 420kV CTs. One impulse per minute shall be applied and every 50 impulse high frequency currents from the windings and total current to earth will be recorded and be compared with reference currents recorded applying one or more (max 20) reduced chopped impulses of 50% of test value.

Oil samples will be taken before and 3 days after the test. Gas analysis must not show appreciable rate of increase in various gases related with the results of the analysis performed before test.

Total sum of crest values of current through secondaries must not exceed 5% of the crest value of total current to earth. CT must withstand dielectric tests after this test to pass the test.

Method II : 100 negative polarity impulses with a rise and fall time of less than 0.25 microsecond having 950 kV for 420 kV CT corrected to atmospheric condition shall be applied at one minute interval and total current through insulation of earth will be recorded. The amplitude of first opposite polarity should be limited to 50% of the chopped impulse crest value. Voltage and total current wave shapes shall be recorded after every 10 impulses, and will be compared with reference wave shapes recorded before test at 50% of test values.

Oil sample shall be taken before and 3 days after the test and CT shall be deemed to have passed the test if the increase in gas content before and after test is not appreciable.

b) Voltage transformers:

- i) High frequency capacitance and equivalent series resistance measurement (as per IEC-358).
- ii) Seismic withstand test (as per Annexure-B of specification).
- iii) Stray capacitance and stray conductance measurement of the low voltage terminal (as per IEC-358).
- iv) Determination of temperature coefficient test (as per IEC-358).
- v) Radio interference test as per Annexure-A of specification.
- vi) The Ferro-resonance type test shall be carried out on the complete CVT.

The current and voltage transformer shall be subjected to the following routine/site tests in addition to routine tests as per IEC/IS.

a) CURRENT TRANSFORMERS:

ROUTINE TESTS:

- i) Measurement of Capacitance.
- ii) High voltage power frequency withstand test on Secondary Winding.
- iii) Over-voltage inter turn test (as per BS:3938).
- iv) Oil leakage test.
- v) Measurement of tan delta at 0.3, 0.7, 1.0 and $1.1U_m/\sqrt{3}$.
- vi) Measurement of partial discharge shall be carried out as per IEC.

SITE TESTS: Dissolved gas analysis to be carried out at the time of commissioning. CTs must have adequate provision for taking oil samples from the bottom of the CT without exposure to atmosphere. Bidder/Manufacturer shall recommend the frequency at which oil samples should be taken and norms for various gases in oil after being in operation for different durations. Bidder/Manufacturer should also indicate the total quantity of oil which can be withdrawn from CT for gas analysis before refilling or further treatment of CT becomes necessary.

b) VOLTAGE TRANSFORMERS:

- i) Capacitance and loss angle measurement before and after voltage test (as per IEC:358).
- ii) Partial discharge test on capacitor dividers (as per IEC-358).
- iii) Sealing test (as per IEC-358).

7.0 SPARE PARTS AND MAINTENANCE EQUIPMENT:

The Bidder shall include in his proposal spare parts equipment in accordance with Section-Project

8.0 TECHNICAL PARAMETERS :

A. 145 kV CURRENT TRANSFORMERS :

1	Rated Primary current	600 A
2	Rated short time thermal current	31.5 kA for 1 sec
3	Rated dynamic current	80 kA (peak)
4	Maximum temperature rise over design ambient temperature	As per IEC:44-1
5	One minute power frequency withstand voltage sec. terminal & earth	5 kV
6	Number of terminals	All terminals of control circuits to be wired upto marshaling box plus 20% spare terminals evenly distributed on all TBs
7	Type of insulation	Class A
Current transformers shall also comply with requirements of Table – IIC/ or IID as applicable		

145 KV VOLTAGE TRANSFORMER

1	System fault level	31.5 kA for 1 second
2	Standard reference range of frequencies for which the accuracies are valid	96% to 102% for protection and 99% to 101% for measurement
3	High frequency Capacitance for entire carrier frequency range	Within 80% to 150% of rated capacitance
4	Equivalent series resistance over the entire carrier frequency range	Less than 40 ohms
5	Stray capacitance and stray conductance of the LV terminal over entire carrier frequency range	As per 1 IEC:358
6	One minute power frequency withstand voltage	
i	Between LV(HF) terminal and earth terminal	10 kV (rms) for exposed terminals and 4 KV (rms) for terminals enclosed in a weather proof box
ii	For secondary winding	3 kV (rms)
7	Maximum temperature rise over Design ambient temperature	As per IEC:186
8	Number of terminals in control cabinet (interpole pole cabling is to be supplied By purchaser	All terminals of are wired upto marshalling box plus 12 terminals exclusively for future use
9	Rated thermal burden (VA) Voltage Transformer shall also Comply with the requirements of Table-IC of this chapter	300 (100 VA/winding)

TESTING & COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./Instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

Current Transformers

- (a) Insulation Resistance Test for primary and secondary.
- (b) Polarity test
- (c) Ratio identification test - checking of all ratios on all cores by primary injection of current
- (d) Magnetising characteristics test
- (e) Tan Delta and capacitance measurement
- (f) Secondary winding resistance measurement

Voltage Transformers/Capacitive Voltage Transformers

- (a) Insulation Resistance test for primary (if applicable) and secondary winding.
- (b) Polarity test
- (c) Ratio test
- (d) Dielectric test of oil (wherever applicable).
- (e) Tan delta and capacitance measurement between :-
 - (i) HV - HF point
 - (ii) HF Point - Ground point of Intermediate Transformer.
 - (iii) HV - Ground point of Intermediate Transformer primary winding
- (f) Secondary winding resistance measurement.

The windings of CT,PT,CVT, Lighting transformers shall be of Copper only.

TABLE - IC REQUIREMENTS OF 145 KV CAPACITIVE VOLTAGE TRANSFORMERS

Sl. No.	Particular	Description
1	Rated primary voltage (kV rms)	145
2	Type	Single phase capacitor VT
3	No. of secondaries	3
4	Rated voltage factor	1.2 continuous 1.5
5	Phase angle error	- 30 seconds ± 20 minutes (For metering core)
6	Capacitance (pf)	8800 + 10%/-5%
7	Voltage Ratio	132/0.11 132/0.11 132/0.11
8	Application	Protection, Protection, Metering
9	Accuracy	3P, 3P, 0.2
10	Output burden (VA) (minimum)	50 50 50

TABLE- II B REQUIREMENTS FOR 145 KV CURRENT TRANSFORMER

TotalNo. of Cores	Core No.	Application	Current Ratio	Output Burden (VA)	Accuracy Class as per IEC 44.1	Minimum Knee Pt. Voltage Vk	Max CT Sec. Winding Resistance (Ohms)	Max. Excitation Current at Vk (in mA)
5	5	DIFF CHECK	1200-600-300-150/1-1-1-1-1 A		PS	600/300/150	6/3/1.5	30 on-600/1 and 60 on-300/1 Tap
	4	DIFF MAIN	1200-600-300-150/1-1-1-1-1 A		PS	600/300/150	Tap 6/3/1.5	30 on-600/1 and 60 on-300/1 Tap
	1	METERING	1200-600-300-150/1-1-1-1-1 A	20	0.2			30 on-600/1 and 60 on-300/1 Tap
	2	LINE PROTN	1200-600-300-150/1-1-1-1-1 A		PS	600/300/150	6/3/1.5	30 on-600/1 and 60 on-300/1 Tap
	3	LINE PROTN	1200-600-300-150/1-1-1-1-1 A		PS	600/300/150	6/3/1.5	30 on-600/1 and 60 on-300/1 Tap

All relative CTs shall be of accuracy class PS as per IS: 270

- (i) The upper part of insulation assembly resting on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly & top dome.
- (ii) Nitrogen if used for hermetic sealing (in case of live tank design) should not come in direct contact with oil.
- (iii) Bidder/Manufacturer shall recommend whether any special storage facility is required for spare CT.
- o) Different ratios specified shall be achieved by secondary taps only and primary reconnection shall not be accepted.
- p) Core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores used for protection shall produce undistorted secondary current under transient conditions at all ratios with specified CT parameters.
- q) The expansion chamber at the top of the porcelain insulators should be suitable for expansion of oil.
- r) Facilities shall be provided at terminal blocks in the marshalling box for star delta formation, short circuiting and grounding of CT secondary terminals.
- s) Current transformer's guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

- t) For 145 kV class CTs, the rated extended primary current shall be 120% (or 150% if applicable) on all cores of the CTs as specified in the specification.
- u) For 145 kV current transformer, characteristics shall be such as to provide satisfactory performance of burdens ranging from 25% to 100% of rated burden over a range of 10% to 100% of rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs.
- v) The current transformer shall be suitable for horizontal transportation. It shall be ensured that the CT is able to withstand all the stresses imposed on it while transporting and there shall be no damage in transit the Contractor shall submit the details of packing design to the Purchaser for review.
- w) For 145 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired upto the terminal blocks.
- x) The wiring diagram plate for the interconnections of the three single phase CTs shall be provided inside the marshalling box. The Bidder/Manufacturer shall strictly adhere to it and deviations, if any, in this regard shall be brought out with justification for Purchaser's review.
- y) The current transformers should be suitable for mounting on lattice support structure to be provided by the Contractor in accordance with stipulations of specification.
- z) The CT shall be designed as to achieve the minimum risks of explosion in service. Bidder/Manufacturer shall bring out in his offer, the measures taken to achieve this.

145 kV current transformers shall be suitable for high speed auto reclosing.

132KV ISOLATOR

TECHNICAL SPECIFICATION FOR 132KV ISOLATOR

GENERAL:

The Isolators and accessories shall conform in general to IEC: 62271-102 (or IS: 9921) except to the extent explicitly modified in specification and shall be in accordance with requirement of specification.

Isolators shall be outdoor, off-load type. Earth switches shall be provided on Isolators wherever called for.

Complete isolator with all the necessary items for successful operation shall be supplied including but not limited to the following.

Isolator assembled with complete base frame, linkages, operating mechanism, control cabinet, interlocks etc.

All necessary parts to provide a complete and operable isolator installation, control parts and other devices whether specifically called for herein or not.

The isolator shall be designed for use in the geographic and meteorological conditions as given in specification.

DUTY REQUIREMENTS:

- a) Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.
- b) The earth switches, wherever provided, shall be constructionally interlocked so that the earth switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.
- c) In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of failsafe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated in specification.

- d) The earth switches shall be capable of discharging trapped charges of the associated lines.
- e) The isolator shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminals of each pole of isolator on account of make/break operation.
- f) The isolator shall be capable of making/breaking magnetizing current of 0.7A at 0.15 powerfactor and capacitive current of 0.7A at 0.15 power factor at rated voltage.

CONSTRUCTIONAL FEATURES:

The features and constructional details of Double Break Isolators, turn twist type earthswitches and accessories shall be in accordance with requirements stated hereunder:

Contacts:

- a) The contacts shall be self aligning and self cleaning and so designed that binding cannot occur after remaining closed for prolonged periods of time in a heavily polluted atmosphere.
- b) No undue wear or scuffing shall be evident during the mechanical endurance tests. Contacts and spring shall be designed so that readjustments in contact pressure shall not be necessary throughout the life of the isolator or earth switch. Each contact or pair of contacts shall be independently sprung so that full pressure is maintained on all contacts at all time.
- c) Contact springs shall not carry any current and shall not lose their characteristics due to heating effects.

Base :

Each single pole of the isolator shall be provided with a complete galvanised steel base provided with holes and designed for mounting on a supporting structure.

Blades :

- a) **All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper.** Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts, shall be made of copper silicon alloy or stainless steel or equivalent. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast-steel. No grey iron shall be used in the manufacture of any part of the isolator.
- b) The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shield shall be provided. Corona shields/rings etc., shall be made up of aluminum/aluminum alloy.
- c) Isolators and earth switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks, or accidental touching of the connecting rods of the operating mechanism.

- d) The switch shall be designed such that no lubrication of any part is required except at very frequent intervals. i.e. after every 1000 operations or after 5 years whichever is earlier.

Insulator :

- a) The insulator shall conform to IS: 2544 and/or IEC-168. The porcelain of the insulator shall conform to the requirements stipulated in specification and shall have a minimum cantilever strength of **600 Kg.** for 145 kV insulators.
- b) Pressure due to the contact shall not be transferred to the insulators after the main blades are fully closed.
- c) The parameters of the insulators shall meet the requirements specified in specification.
- d) Insulator shall be type and routine tested as per IEC-168. Besides following additional tests shall also be conducted:
- (i) Bending load test in four directions at 50% of minimum bending load guaranteed on all insulators, as a routine test.
 - (ii) Bending load test in four directions at 100% of minimum bending load as a sample test on each lot.
 - (iii) Torsional test on sample insulators of a lot.
 - (iv) Ultrasonic test as a routine test.
- e) For 145 kV Insulator : (For Isolator)

Top PCD	127 mm
No. of holes	4 x M16
Bottom PCD	254 mm
No. of holes	8 x 18 dia

Name Plate:

The name plate shall conform to the requirements of IEC incorporating year of manufacture.

OPERATING MECHANISM :

- a) The bidder shall offer motor operated Isolators and earth switches.
- b) Control cabinet/operating mechanism box shall conform to the requirements stipulated in specification and shall be made of aluminum sheet of adequate thickness (minimum 3 mm).
- c) A “Local/Remote” selector switch and a set of open/ close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons.

- d) Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.
- e) Motor shall be an AC motor and conform to the requirements of specification.
- f) Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop immediately when motor supply is switched off. If necessary, a quick electromechanical brake shall be fitted on the higher speed shaft to effect rapid braking.
- g) Manual operation facility (with handle) should be provided with necessary interlock to disconnect motor.
- h) Gear should be of forged material suitably chosen to avoid bending/jamming on operation after a prolonged period of non-operation. Also, all gear and connected material should be so chosen/surface treated to avoid rusting.
- i) The test report for blocked rotor test of motor shall be submitted as per the requirement of Technical Specification.

OPERATION :

- a) The main Isolator and earth switches shall be individual pole operated gang operated in case of 145 kV. The operating mechanism of the three poles shall be well synchronized and interlocked.
- b) The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and inter pole operating rods shall be capable of adjustments, by means of screw thread which can be locked with a lock nut after an adjustment has been made. The isolator and earth switch shall be provided with “over center” device in the operating mechanism to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures.
- c) Each isolator/pole of isolator and earths shall be provided with a manual operating handle enabling one man to open or close the isolator with ease in one movement while standing at ground level. The manual operating handle shall have provision for pad locking. The operating handle shall be located at a height of 1000 mm (approximately) from the base of isolator support structure.
- d) The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes and rods shall be sufficiently rigid to maintain positive control under the most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsional and bending stresses due to operation of the isolator. Wherever supported the operating rods shall be provided with bearings on either ends. The operating rods/ pipes shall be provided with suitable universal couplings to account for any angular misalignment.

- e) All rotating parts shall be provided with grease packed roller or ball bearings in sealed housings designed to prevent the ingress of moisture, dirt or other foreign matter. Bearings pressure shall be kept low to ensure long life and ease of operation. Locking pins wherever used shall be rustproof.
- f) Signaling of closed position shall not take place unless it is certain that the movable contacts, have reached a position in which rated normal current, peak withstand current and short time withstand current can be carried safely. Signaling of open position shall not take place unless movable contacts have reached a position such that clearance between contacts is at least 80% of the isolating distance.
- g) The position of movable contact system (main blades) of each of the Isolators and earth switches shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the Isolators and earth switch. The indicator shall be of metal and shall be visible from operating level.
- h) The contractor shall furnish the following details along with quality norms, during detailed engineering stage.
 - (i) Current transfer arrangement from main blades of isolator along with millivolt drop immediately across transfer point.
 - (ii) Details to demonstrate smooth transfer of rotary motion from motor shaft to the insulator along with stoppers to prevent over travel.

7.0 TERMINAL CONNECTORS:

The terminal connector shall meet the requirements as given in specification.

8.0 SUPPORT STRUCTURE:

145 kV Isolators shall be suitable for mounting on support structures to be supplied in accordance with specification.

TESTS:

In continuation to the requirements stipulated under specification, the isolator along with its earth switch and operating mechanism should have been type tested as per IEC/IS and shall be subjected to routine tests in accordance with IEC-129/IEC-1129. Power frequency voltage withstand tests shall be performed on at least one completely assembled isolator pole of each type. Alternatively, power frequency test may be performed on two nos. of Post Insulators (complete) for each voltage rating and type of Isolator. Minimum 50 Nos. mechanical operations will be carried out on 1 (one) isolator out of every ten Isolators assembled completely with all accessories as acceptance test for the lot.

Site Tests:

All routine tests including 50 operation test, except power frequency dry voltage withstand test on isolator shall be repeated on completely assembled isolator of each type at site.

TECHNICAL PARAMETERS: 145 kV ISOLATORS:

Type	Outdoor
Rated Current at 50deg. Ambient temperature	1250/1600 A as applicable and detailed under price schedule
Rated short time withstand current of isolator and earth switch	31.5 kA for 3 Sec
Rated dynamic short circuit withstand current of isolator and earth switch	80 kAp
Temperature rise over design ambient temperature	As per table V of IEC-694.
Rated mechanical terminal load.	As per table III of IEC-129(1984) or as per value calculated in Chapter-GTR whichever is higher.
Operating mechanism of isolator/earth switch	A.C. Motor operated
No. of auxiliary contacts on each isolator	Besides requirement of this spec., 8NO + 8 NC to contacts, wired to terminal block exclusively for Purchaser's use in future.
No. of auxiliary contacts on each earthing switch	Besides requirement of this spec., the bidder shall wire up 3 NO + 3 NC to TBs (Reversible) for Purchaser's future use.
Operating time	12 sec. or less
Number of terminals in control cabinet (Interpole cabling shall be supplied by Contractor)	All contacts & control circuits are to be wired up to control cabinet plus 24 spare terminals evenly distributed.

TESTING AND COMMISSIONING

An indicative list of tests on isolator and earth switch is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or Purchaser without any extra cost to the Purchaser. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Purchaser for approval.

- (a) Insulation resistance of each pole.
- (b) Manual and electrical operation and interlocks.
- (c) Insulation resistance of control circuits and motors.
- (d) Measurement of operating Torque for isolator and Earth switch.
- (e) Resistance of operating and interlocks coils.

CIRCUIT BREAKERS

SPECIFICATION FOR CIRCUIT BREAKERS

1.0 GENERAL

The circuit breakers and accessories shall conform to IEC: 62271- 100, IEC: 60694 and other relevant IEC standards except to the extent explicitly modified in the specification and shall also be in accordance with requirements specified in specification.

145 kV circuit breakers offered would be of Sulphur Hexafluoride (SF6) type only and of class C1-M2 as per IEC. The bidder may also offer circuit breakers of either live tank type or dead tank type of proven design.

The circuit breaker shall be complete with terminal connectors, operating mechanism, control cabinets, piping, inter pole cable, cable accessories like glands, terminal blocks, marking ferrules, lugs, pressure gauges, density monitors (with graduated scale), galvanised support structure for CB and control cabinets, their foundation bolts and all other circuit breaker accessories required for carrying out all the functions the CB is required to perform.

All necessary parts to provide a complete and operable circuit breaker installation such as main equipment, terminals, control parts, connectors and other devices whether specifically called for herein or not shall be provided.

The support structure of circuit breaker as well as that of control cabinet shall be hot dip galvanized. All other parts shall be painted as per shade 697 of IS -5.

The circuit breakers shall be designed for use in the geographic and meteorological conditions as given in specification.

DUTY REQUIREMENTS:

The circuit breakers shall be capable of performing their duties without opening resistors.

The circuit breaker shall meet the duty requirements for any type of fault or fault location also for line switching when used on a 145 KV effectively grounded system, and perform make and break operations as per the stipulated duty cycles satisfactorily.

The breaker shall be capable of interrupting the steady state and transient magnetizing current corresponding of power transformers.

The circuit breaker shall also be capable of:

- i) Interrupting line/cable charging current as per IEC without use of opening resistors.
- ii) Clearing short line fault (Kilometric faults) with source impedance behind the bus equivalent to symmetrical fault current specified.
- iii) Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition.

The Breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energization of lines with trapped charges. The breaker shall also withstand the voltages specified under clause – 17. of this specification.

TOTAL BREAK TIME:

The total break time as specified under this Chapter shall not be exceeded under any of the following duties:

- i) Test duties 1,2,3,4,5 (TRV as per IEC: 62271-100)
- ii) Short line fault L75, L90 (- do -)

The Bidder may please note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage and arc extinguishing medium pressure etc. While furnishing the proof of the total break time of complete circuit breaker, the Bidders may specifically bring out the effect of non-simultaneity between contacts within a pole or between poles and show how it is covered in the guaranteed total break time.

The values guaranteed shall be supported with the type test reports.

CONSTRUCTIONAL FEATURES:

The features and constructional details of circuit breakers shall be in accordance with requirements stated hereunder:

Contacts

- 4.1.1 The gap between the open contacts shall be such that it can withstand at least the rated phase to ground voltage for 8 hours at zero gauge pressure of SF6 gas due to the leakage. The breaker should be able to withstand all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. 2 p.u. across the breaker continuously).
- 4.1.2 If multi break interrupters are used, these shall be so designed and augmented that a uniform voltage distribution is developed across them. Calculations/ test reports in support of the same shall be furnished. The thermal and voltage withstand of the grading elements shall be adequate for the service conditions and duty specified.

The SF6 Circuit Breaker shall meet the following additional requirements

- a) The circuit breaker shall be single pressure type. The design and construction of the circuit breaker shall be such that there is a minimum possibility of gas leakage and entry of moisture. There should not be any condensation of SF6 gas on the internal insulating surfaces of the circuit breaker.
- b) All gasketed surfaces shall be smooth, straight and reinforced, if necessary, to minimize distortion and to make a tight seal, the operating rod connecting the operating mechanism to the arc chamber (SF6 media) shall have adequate seals. The SF6 gas leakage should not exceed 1% per year. In case the leakage under the specified conditions is found to be greater than 1% after one year of commissioning of circuit breaker, the manufacturer will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during first year of operation after commissioning.

- c) In the interrupter assembly there shall be an absorbing product box to minimize the effect of SF6 decomposition products and moisture. The material used in the construction of the circuit breakers shall be such as fully compatible with SF6 gas decomposition products.
- d) For CBs of voltage class of 145 kV or less, a common SF6 scheme/density monitor shall be acceptable.
- e) The dial type SF6 density monitor shall be adequately temperature compensated to model the pressure changes due to variations in ambient temperature within the body of circuit breaker as a whole. The density monitor shall have graduated scale and shall meet the following requirements:
 - i) It shall be possible to dismantle the density monitor for checking/replacement without draining the SF6 gas by providing suitable interlocked non return valve coupling.
 - ii) Each Circuit Breaker shall be capable of withstanding a vacuum of minimum 8 millibars without distortion or failure of any part.
 - iii) Sufficient SF6 gas including that will be required for gas analysis during filling shall be provided to fill all the circuit breakers installed. In addition, spare gas shall be supplied in separate unused cylinders as per requirement specified.

Provisions shall be made for attaching an operational analyzer after installation of circuit breakers at site to record contact travel, speed and making measurement of operating timings, preinsertion timings of closing resistors if used, synchronization of contacts in one pole. In case operation analyzer is already available at a particular site, the contractor shall have to supply a suitable adapter/transducer so that the offered circuit breaker can be used with the operational analyzer.

5.0 SULPHUR HEXAFLUORIDE GAS (SF6 GAS):

- a) The SF6 gas shall comply with IEC 376, 376A and 376B and shall be suitable in all respects for use in the switchgear under the operating conditions.
- b) The high-pressure cylinders in which the SF6 gas is shipped and stored at site shall comply with requirements of the relevant standards and regulations.
- c) Test: SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water content as per IEC 376, 376A and 376B and test certificates shall be furnished to Employer indicating all the tests as per IEC 376 for each lot of SF6 gas in stipulated copies as indicated in specification. Gas bottles should be tested for leakage during receipt at site.

6.0 Insulators

- a) The porcelain of the insulators shall conform to the requirements stipulated under specification.
- b) The mechanical characteristics of insulators shall match with the requirements specified under this Chapter.
- c) All insulators shall conform to IEC-61264 (for pressurized hollow column insulators) and IEC-233 (for others). All routine and sample tests shall be conducted on the hollow column insulators as per these standards with requirements and procedures modified as under:
 - i) Pressure test as a routine test.
 - ii) Bending load test as a routine test.
 - iii) Bending load test as a sample test on each lot.
 - iv) Burst pressure test as a sample test on each lot.
 - v) In addition to above, ultrasonic test shall be carried out as additional routine test.
- d) Hollow Porcelain for pressurized columns/chambers should be in one integral piece in green and fired stage.

OPERATING MECHANISM AND CONTROL

General Requirements

Circuit breaker shall be operated by spring charged mechanism. The mechanism shall be housed in a weather proof and dust proof control cabinet as stipulated in specification. The operating mechanism shall be strong, rigid, not subject to rebound and shall be readily accessible for maintenance for a man standing on ground.

The mechanism shall be anti-pumping and trip free (as per IEC definition) under every method of closing.

The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause trip or closing operation of the power operating devices.

A mechanical indicator shall be provided to show open and close position of the breaker. It shall be located in a position where it will be visible to a man standing on the ground level with the mechanism housing closed. An operation counter shall also be provided in the central control cabinet.

Working parts of the mechanism shall be corrosion resisting material, bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned or locked to prevent loosening or changing adjustment with repeated operation of the breaker.

The bidder shall furnish detailed operation and maintenance manual of the mechanism along with the operation manual for the circuit breaker. The instruction manuals shall contain exploded diagrams with complete storage, handling, erection, commissioning, troubleshooting, servicing and overhauling instructions.

Control:

The close and trip circuits shall be designed to permit use of momentary contact switches and push buttons.

Each breaker pole shall be provided with two (2) independent tripping circuits, pressures switches and coils each connected to a different set of protective relays.

The breaker shall normally be operated by remote electrical control. Electrical tripping shall be performed by shunt trip coils. However, provisions shall be made for local electrical control. For this purpose a local/remote selector switch and close and trip control switch/push buttons shall be provided in the Breaker central control cabinet.

The trip coils shall be suitable for trip circuit supervision during both open and close position of breaker. The trip circuit supervision relay would be provided on relay panels. Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip coil and associated circuits shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. However, even at 50% of rated voltage the breaker shall be able to open. If additional elements are introduced in the trip coil circuit their successful operation and reliability for similar applications on outdoor circuit breakers shall be clearly brought out in the additional information schedules.

Density Meter contacts and pressure switch contact shall be suitable for direct use as permissive in closing and tripping circuits. Separate contacts have to be used for each of tripping and closing circuits. If contacts are not suitably rated and multiplying relays are used then fail safe logic/schemes are to be employed. DC supplies for all auxiliary circuits shall be monitored and provision shall be made for remote annunciations and operation lockout in case of D.C. failures. Density monitors are to be so mounted that the contacts do not change on vibration during operation of circuit Breaker.

The auxiliary switch of the breaker shall be positively driven by the breaker operating rod.

The preferred basic control schematic of the Circuit breaker is enclosed with the bid documents and it is expected to be followed by the bidder. This, however, does not absolve the bidder from the responsibility for safe and reliable operation of the breaker in its lifetime.

Spring operated mechanism:

- a) Spring operated mechanism shall be complete with motor in accordance with specification. Opening spring and closing spring with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also be provided.
- b) As long as power is available to the motor, a continuous sequence of the closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.
- c) After failure of power supply to the motor one close open operation shall be possible with the energy contained in the operating mechanism.
- d) Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring.
- e) Closing action of circuit breaker shall compress the opening spring ready for tripping.

- f) When closing springs are discharged after closing a breaker, closing springs shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control cabinet.
- g) Provisions shall be made to prevent a closing operation of the breaker when the spring is in the partial charged condition. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in the closed position.
- h) The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case the tripping energy is derived from the operating mechanism.

SUPPORT STRUCTURE:

- a) The structure design shall be such that during operation of circuit breaker vibrations are reduced to minimum.
- b) If required, the Contractor shall provide suitable platform with steps on both sides of the circuit breaker for easy accessibility for monitoring the density/pressure of gas.

10.0 TERMINAL CONNECTOR PAD:

The circuit breaker terminal pads shall be made up of high quality electrolytic copper or aluminum. The terminal pad shall have protective covers which shall be removed before interconnections.

INTERPOLE CABLING:

All cables to be used by contractor shall be armoured and shall be as per IS - 1554 (1100 Volts Grade). All cables within & between circuit breaker poles shall be supplied by the CB manufacturer.

Only stranded conductor shall be used. Minimum size of the conductor shall be 2.5 sq.mm. (Copper).

The cables shall be with oxygen index Min-29 and temp. index as 250° C as per relevant standards.

FITTINGS AND ACCESSORIES

Following is a partial list of some of the major fittings and accessories to be furnished by Contractor in the Central Control cabinet. Number and exact location of these parts shall be indicated in the bid.

- i) Cable glands (Double compression type), Lugs, Ferrules etc.
- ii) Local/remote changeover switch.
- iii) Operation counter
- iv) Control switches to cut off control power supply.
- v) Fuses as required.
- vi) The number of terminals provided shall be adequate enough to wire out all contacts and control circuits plus 24 terminals spare for future use.
- vii) Anti-pumping relay.
- ix) Pole discrepancy relay.

- x) D.C. Supervision relays.
- xi) Rating and diagram plate in accordance with IEC incorporating year of manufacture.

ADDITIONAL DATA TO BE FURNISHED ALONGWITH THE OFFER:

- a) Drawing, showing contacts in close, arc initiation, full arcing, arc extinction and open position.
- b) The temperature v/s pressure curves for each setting of density monitor along with details of density monitor.
- c) Method of checking the healthiness of voltage distribution devices (condensers) provided across the breaks at site.
- d) Data on capabilities of circuit breakers in terms of time and number of operations at duties ranging from 100% fault currents to load currents of the lowest possible value without requiring any maintenance or checks.
- e) The effect of non-simultaneity between contacts between poles and also show how it is covered in the guaranteed total break time.
- f) Sectional view of non-return couplings if used for SF6 pipes.
- g) Details & type of filters used in interrupter assembly and also the operating experience with such filters.
- h) Details of SF6 gas:
 - i) The test methods used in controlling the quality of gas used in the circuit breakers particularly purity and moisture content.
 - ii) Proposed tests to assess the conditions of the SF6 within a circuit breaker after a period of service particularly with regard to moisture contents of the gas.
- i) A complete catalogue on operation analyser satisfying all the requirements of this Chapter.
- j) The bidders shall furnish along with the bid, curves supported by test data indicating the opening time under close open operation with combined variation of trip coil voltage and pneumatic/hydraulic pressure.
- k) Field test report or laboratory test report in case of CB meant for reactor switching duty.

TESTS:

In accordance with the requirements stipulated under specification the circuit breaker along with its operating mechanism shall conform to IEC:62271-100.

The test reports of the type tests and the following additional type tests shall also be submitted for Purchaser's review:

- i) Corona extinction voltage test .
- ii) Out of phase closing test as per IEC:62271-100.
- iii) Line charging breaking current for proving parameters as per clause no. 17.9 of this Chapter.
- iv) Test to demonstrate the Power Frequency withstand capability of breaker in open condition at Zero Gauge pressure and at lockout pressure.
- v) Seismic withstand test in unpressurised condition.
- vi) Verification of the degree of protection.
- vii) Low & high temperature test.(if applicable)
- viii) Humidity test.(if applicable)
- ix) Static Terminal Load test.
- x) Critical Currents test (if applicable).
- xi) Switching of Shunt Reactors.

Routine Tests

Routine tests as per IEC:62271-100 shall be performed on all circuit breakers.

In addition to the mechanical and electrical tests specified by IEC, the following tests shall also be performed.

- 1) Speed curves for each breaker shall be obtained with the help of a suitable operation analyzer to determine the breaker contact movement during opening, closing, auto- reclosing and trip free operation under normal as well as limiting operating conditions(control voltage, pneumatic/hydraulic pressure etc.). The tests shall show the speed of contacts directly at various stages of operation, travel of contacts, opening time, closing time, shortest time between separation and meeting of contacts at break make operation etc. This test shall also be performed at site for which the necessary operation analyzer along with necessary transducers, cables, console, etc. where included in scope of supply shall be furnished and utilized. In case of substations where operation analyzer is existing the bidder shall utilize the same. However necessary adopter and transducers etc. if required shall have to be supplied by the bidder.
- 2) Measurement of Dynamic Contact resistance measurement for arcing & main contacts. Signature of Dynamic contact resistance measurements shall be taken as reference for comparing the same during operation and maintenance in order to ascertain the healthiness of contacts.

Site Tests: All routine tests except power frequency voltage dry withstand test on main circuitbreaker shall be repeated on the completely assembled breaker at site.

DEAD TANK TYPE CIRCUIT BREAKER

In case dead tank type circuit breaker is offered, the Bidder shall offer bushing type CTs on either side of dead tank circuit breaker instead of conventional outdoor CTs.

The enclosure shall be made of either Al/Al Alloy or mild steel (suitably hot dip galvanized).

The enclosure shall be designed for the mechanical and thermal loads to which it is subjected in service. The enclosure shall be manufactured and tested according to the pressure vessel codes [i.e., latest edition of the ASME code for pressure vessel - Section VIII of BS-5179, IS4379, IS-7311 (as applicable) and also shall meet Indian Boiler Regulations].

The maximum temperature of enclosure with CB breaker carrying full load current shall not exceed the ambient by more than 20 deg C.

The enclosure has to be tested as a routine test at 1.5 times the design pressure for one minute. A bursting pressure test shall be carried out at 5 times the design pressure as type test on the enclosure.

16.0 Blank

17.0 TECHNICAL PARTICULARS

145 kV CIRCUIT BREAKER:

Rated continuous current (A) at design ambient temperature	3150 A
Rated short circuit current breaking capacity at rated voltage	40 kA for 1 Sec with percentage DC component as per IEC: 62271-100 corresponding to minimum opening time under operating conditions specified
Symmetrical interrupting capability (kA rms)	40 KA
Rated short circuit making current (kA _p)	80
Short time current carrying capability for one second (kA rms)	40 KA
Out of phase braking current capacity (kA rms)	As per IEC
Rated operating duty	O-0.3sec-CO-3min-CO cycle
Auto Reclosing	Three phase auto reclosing
Rated line/cable charging interrupting current at 90 deg. leading power factor angle (A. rms)	The breaker shall be able to interrupt the rated line/cable charging current with test voltage immediately before opening equal to the product of $U/\sqrt{3}$ & 1.4 as per IEC: 62271-100
Design ambient temperature	As per IEC: 62271-100 65

Total break time as per Cl.3.0 of this Chapter(ms)	60
Rated break time as per IEC (ms)	Not more than 150
Operating mechanism or acombination of these	Spring
Max. difference in the instants of closing/ opening of contacts (ms) between poles at rated control voltage and rated operating and quenching media pressures.	3.3
Trip coil and closing coil voltage	
Noise level at base and upto 50 m (distance from base of breaker)	140 dB (Max.)
Auxiliary contacts	Besides requirement of specification, the bidder shall wire up 5 NO + 5 NC contacts for future use of Purchaser.
No. of Terminals in common control cabinet	All contacts & control circuits to be wired out up to common control cabinet plus 24 terminals exclusively for Purchaser's use.
Maximum allowable switching Overvoltage under any switching condition	As per IEC
Rated small inductive current switching capability with overvoltage less than 2.3 p.u.(A)	0.5 to 10

TESTING AND COMMISSIONING

An indicative list of tests is given below. Contractor shall perform any additional test based on specialties of the items as per the field Q.P./instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

- (a) Insulation resistance of each pole.
- (b) Check adjustments, if any suggested by manufacturer.
- (c) Breaker closing and opening time.
- (d) Slow and Power closing operation and opening.
- (e) Trip free and anti pumping operation.
- (f) Minimum pick-up voltage of coils.
- (g) Dynamic Contact resistance measurement.
- (h) Functional checking of compressed air plant and all accessories.
- (i) Functional checking of control circuits interlocks, tripping through protective relays and auto reclose operation.
- (j) Insulation resistance of control circuits, motor etc.
- (k) Resistance of closing and tripping coils.
- (l) SF6 gas leakage check.
- (m) Dew Point Measurement
- (n) Calibration of pressure switches and gas density monitor.
- (o) Checking of mechanical „CLOSE“ interlock, wherever applicable

POST INSULATOR

GENERAL TECHNICAL REQUIREMENT FOR POST INSULATORS.

1. SCOPE :

This specification covers the design manufacture. Testing at manufacturers works, supply and delivery F.O.R. destination of POST INSULATORS for use in outdoor grid substations of Bihar State Electricity Board.

2. STANDARDS :

The insulators covered under this specification shall comply with the requirements of latest edition of IS:2644-1973 or IEC-168-1964 (as amended upto date) except where specified otherwise in the specification.

3. DRAWINGS:

Drawings in quadruplicate incorporating the following particulars shall be submitted by each tenderer with the tender for the purpose of preliminary study.

- i) General outline drawing showing all dimension, net weights, shipping weights etc.
- ii) A copy of catalogue giving full details for the insulators.
- iii) Sectional views showing the general constructional features.

Within 15 days of the receipt of the order the tenderer shall submit the following drawings in quadruplicate for approval of the purchaser:

- a) Drawing showing details of insulators with dimensions.
- b) Assembly drawing showing the complete stacks/erected as desired for 132 kV systems, with full dimensions and accessories.

Tenderer may furnish any other drawing found necessary in addition to those stated above.

4. DESIGN AND GENERAL REQUIREMENT:

The post insulator unit shall have two metal parts, a cap partially embracing and insulating component and pedestal cemented into a recess in the insulating component. The cap shall have holes for retaining attachment bolts may pass.

The post insulator one unit or a number of units bolted together shall be designed to support and insulate high voltage busbars and isolators. These shall be designed to withstand tensile, torsional cantilever and compressive loads as specified in this specification.

Normally these insulators shall be mounted upright but in some cases other mounting arrangements may also be required for which the insulator shall also be designed.

The insulators shall be fabricated by the wet process. The insulating porcelain and the metal parts shall be assembled together with such materials and in such manner that any thermal expansion of the metal and the porcelain part through out the range of operating temperature shall not lessen the parts or create under stress adversely affecting the electrical and mechanical strength specified in the specification.

The post insulators shall be designed and manufactured in such a manner that the following are avoided:

- a) Stresses due to expansion and contraction which may lead to deterioration in use.
- b) Stress concentration due to direct engagement of the porcelain with metal fitting.
- c) Shapes which do not facilitate easy cleaning by normal methods.

5. PORCELAIN:

The porcelain shall be sound, free from defects, truly vitrified and smoothly glazed. The glaze shall be brown in colour. The glaze shall cover all the exposed porcelain parts except those areas which serve as support during firing or are required to be left unglazed. The unglazed part shall not have a total area exceeding.

6. MARKING :

Each insulator shall be legibly and indelibly marked to show the following:

- a) Name of trademark of the manufacturer.
- b) Month and year of manufacture.
- c) Country of manufacture.

Marking on porcelain shall be printed and shall be applied before firing. In case in the insulators possess any ISI mark, the same shall also be printed.

7. CREEPAGE DISTANCE:

The tenderer shall specify in tender the creepage distance of the insulators. The minimum distance, for insulators is specified in specification.

8. MECHANICAL LOADS:

The insulator shall be suitable for minimum failing loads specified in specification. Load shall be applied axially to the insulator stanch.

9. TEST:

TYPE TEST: Type tests are intended to demonstrate compliance of the design of the insulator with the requirements of specification. An insulator subjected to type tests may be unsuitable for subsequent use in service. Type tests shall be made on an insulator that has passed the routine test.

VISIBLE DISCHARGE TEST (POWER FREQUENCY VOLTAGE)

The test room shall be darkened and a period of five minutes shall be allowed for the observer to become accustomed to darkness. A power frequency test voltage specified in specification, shall be applied and maintained at this value for five minutes. During this test observation shall be made and there shall be no sign of visible corona.

IMPULSE VOLTAGE WITH STAND TEST:

The post insulator or post insulator units shall be tested dry with both positive and negative polarity unless it is known which polarity gives the lowest withstand value, in which case it is sufficient to test with that polarity. The value of impulse voltage shall be as specified in specification and shall be corrected for the atmospheric conditions given at section-III. Five consecutive impulse voltage waves shall be applied. If flash over or puncture does not occur, the insulator shall be considered to have passed the test. If during these five waves puncture occur or if two of the applied waves cause flashover through air, the insulator shall be considered to have failed. If only one of applied waves causes flash over through air, ten additional test waves should be applied. The insulator shall be considered to have passed this test only if flashover through air or puncture does not occur for any of these additional 10 waves.

IMPULSE VOLTAGE FLASH OVER TEST:

The impulse generator shall be adjusted to deliver the required impulse wave. The 50 per cent impulse flash over voltage shall then be determined. At least 20 applications near the required value shall be made to determine it with reasonable accuracy. The polarity shall then be reversed and 50 per cent flashover voltage for the opposite polarity measured in a similar manner.

The insulator shall not be damaged by these tests but slight marking on the surface of the insulating parts or oblique of the cement used for assembly shall be permitted.

The impulse flashover voltage to be recorded shall be the positive and negative 50 per cent impulse flashover voltage measured in accordance with and corrected in accordance with reference atmospheric condition.

DRY ONE MINUTE POWER FREQUENCY WITH STAND TEST:

The post insulator or post insulator units shall be tested at the value of test voltage specified in section-III. Suitable correction shall be done taking into account the atmospheric condition. The test voltage shall be applied for one minute. The insulator shall not flashover or puncture during the test.

WET ONE MINUTE POWER FREQUENCY WITHSTAND TEST:

The test object shall be subjected to a spray of water of prescribed resistivity given in the characteristics of the spray indicated below. The spray consisting of small drops shall fall on the test object at an angle of approximately 45° to the vertical as determined by visual observations, or by measurements of the vertical and horizontal components of the spray. These components shall be measured with a collecting vessel having a horizontal opening of area 100 to 750 Sq. cm. when both vertical and horizontal components are required, the horizontal components shall be measured with a collecting vessels having a similar vertical opening, located on the side of the test object facing the spraying nozzles and as close to the test object as is possible without collecting splashes from it. The test object should be sprayed for at least one minute before the application of the voltage.

The characteristics of the spray shall be as given below:

Precipitation rate.

(mm/min/vertical component) 3 10% \pm

Resistivity of water

(Ohm. Cm.) 10,000 10% \pm

Temperature of water (0C) Ambient 15 \pm

The value of test voltage to be applied has been specified in section-III. Taking into account the atmospheric conditions, the test voltage shall be applied for one minute. The insulator shall not flashover or puncture during the test.

The test voltage shall then be gradually increased from about 10 per cent of the net one minute withstand voltage value to reach the flashover voltage in not less than 5 seconds.

POWER FREQUENCY PUNCTURE WITHSTAND TEST:

The insulators, after having been cleaned and dried, shall be completely immersed in a tank containing a suitable insulating medium to prevent surface discharges on them. If the tank be made of metal, its dimensions shall be such that the shortest distance between any part of the insulator and side of the tank is not less than 13 times the diameter of the largest insulator shed.

The test voltage shall be applied between those parts which normally have the operating voltage between them. During immersion in the insulation medium precautions shall be taken to avoid air pockets under the sheds of the insulator. The voltage shall be increased rapidly to the specified dry one minute power frequency test voltage and then rapidly increased at a rate of about 100 volts per second until the puncture withstand voltage is reached. No puncture shall occur at this voltage for the minimum time necessary to measure it.

MECHANICAL STRENGTH TEST:

Test post insulator or post insulator units shall be attached to the mounting face of the testing machine by its normal method of mounting. The mechanical strength test of the post insulator or post insulator units shall in general consist of the test given in specification unless otherwise specified the test given shall be made.

BENDING TEST:

The load shall be applied to the free end of the post insulator or post insulator units. The direction of loading shall pass through the axis of the insulator and shall be at right angles to it. The load shall be applied gradually starting from a value not greater than half the specified minimum failing load and shall be increased until the specified minimum failing load is reached. The insulator shall pass the test if there is no failure at this load.

TORSION TEST:

The load shall be applied to the free end of the post insulator or post insulator units. The direction of loading shall pass through the axis of the insulator and shall be at right angles to it. The load shall be applied gradually starting from a value not greater than half the specified minimum failing load and shall be increased until the specified minimum failing load is reached. The insulator shall pass the test if there is no failure at this load.

The post insulator or post insulator unit shall be subjected to a tensional load avoiding all bending moment. The torsion test and load shall be applied gradually starting from a value not greater than half the specified minimum failing load and failure shall not take place below the specified minimum failing load. The load may then be increased to the failing load, which may be noted for information.

TENSILE OR COMPRESSION TEST:

The post insulator or post insulator units shall be subjected to a tensional or compression load along its axis. The tensile or compression load shall be applied gradually starting from a value not greater than half the specified minimum failing load. The load may then be increased to the failing load which may be noted for information.

10. SAMPLE TEST:

Suitable number of individual post insulators and complete units or one-unit solid core shall be subjected to tests as per IS-2544-1973 or any other equivalent authoritative standard.

The insulators after having withstood the routine test shall be subjected to the following tests in order as indicated below:

11. VERIFICATION OF DIMENSIONS:

It shall be verified that the post insulator or post insulator units in accordance with the relevant drawings tolerance of $(0.3d \pm 0.3)$ mm shall be allowed for all dimension and the dimension should be in millimeters.

12. TEMPERATURE CYCLE TEST:

The insulator shall be completely and quickly immersed in a water bath maintained at a temperature of the degree centigrade given in the table above that of the cold water and left submerged for T minutes where T $(15 \pm 0.7M)$ M being the mass of the insulator in Kg. It shall then be withdrawn and quickly and completely immersed without being placed in an intermediate container in a bath of cold water or the same period to T minutes.

Table Temp, difference in degree.

Volume	Temperature	Difference	T deg. For	Thickness		Over 40
D ² L	Up to over 23	to 32	Over 32 up to 36	Over 36 up to 43		
	23 Up to 26					
Up to 0.164 over	60	55	50	45	45	35
0.410/0.164 up to 55 over	55	55	50	45	40	35
0.655/0.410 up to 50 over	50	50	50	45	35	35
0.900/0.655 up to over	45	45	45	45	40	35
1.105/0.900 up to over	40	40	40	40	40	35
Over 1.150	35	35	35	35	35	35

L = The greatest external diameter of the insulators. L = The height of the insulator.

Notes :- The thickness shall be the greatest thickness of the insulator as defined as the diameter of the biggest section through the axis of the insulator.

- 13.** The complete test shall comprise five transfer cold to hot, hot to cold, cold to hot, hot to cold, cold to hot. The time taken to transfer the insulator from one bath to the other shall be as short as possible and shall not exceed 30 second. The quantity of water in the test tank shall be large enough not to cause a temperature variation of more than 5° in the water when the insulator is immersed.

After the completion of immersion, the insulator shall be examined to verify that the insulating parts have not cracked nor the fittings are loosened and that the glass is undamaged.

14. POWER FREQUENCY PUNCTURE WITHSTAND TEST:

The test given in 8.7 shall be carried out. If one or more samples fail to comply with the requirement of this test, a test in accordance with 16 shall be made.

15. POROSITY TEST:

Porcelain fragments from the insulator or by agreement from representative pieces of porcelain fired adjacent to them, shall be immersed in one per cent alcoholic solutions of fuchsin (100g of methylated spirit) under a pressure of not less than 150 Kg/Cm² for a period such that the product of test duration in hour and the test pressure in Kg/Cm² is not less than 1800.

The fragments shall then be removed from the solution, washed, dried and broken. Examination with naked eye of the fresh broken surface shall not reveal any dye penetration. Penetration in small cracks formed during the initial breaking shall be neglected.

16. GALVANISATION TEST:

The galvanized metal fittings of the insulator shall comply with the test given in IS 728-1956 method of determination of weight thickness and uniformity of coating on galvanized articles other than wire and sheets. If one or more samples fail to.

If one or more samples fail to comply with the requirement of this test a retest in accordance with 2.21.16 shall be made.

17. RETEST AND REJECTION:

If only one insulator or meta part fails to comply with anyone of the tests given in specification a new quantity equal to twice the first quantity shallbe subjected to retesting. The retesting shall comprise the test in whichfailure occurred preceded by those tests which may be considered to have influenced the result of the original tests. If no failure occurs, the lot shallbe O.K.

If two or more insulators or metal parts fail to comply with any of thetests given in specification or if any failure occurs on insulators or metal parts subjected to retesting as in specification, complete lot shall be with drawn for the further examination by the manufacturer after which the lot or may part thereof may be resubmitted for tests. The number then selected shall be three times the first quantity chosen for test. This retesting shall comprise the test in which the failure occurred preceded by those test which may be considered to have influenced. There sults or the original tests.

18. ROUTINE TEST:

Routine tests shall be conducted on every insulator as per the order given below:

19. VISUAL EXAMINATION:

A visual examination of the insulator shall be made. The insulator shall be free from physical distortion of shape and the vitrified glaze shall be hard and smooth and free from cracks or any other defect likely to be prejudicialto satisfactory performance in service, with exception of area serving as supports during firing are left unglazed for the purpose of assembly the unglazed face shall not come a total area exceeding.

$$1 + \frac{DL}{1000} \text{ Cm. Square.}$$

Where D = greatest external diameter.

L = Height of the insulator.

Also the area of any single defect shall not exceed:

$$0.5 + \frac{DL}{1000} \text{ Cm. Square.}$$

Such unglazed area shall be already shown in the drawing submitted by the manufacturer.

20. MECHANICAL TEST:

Every post insulator unit shall be subjected to a mechanical test at a load not less than 10 per cent of the specified tensile failing load of the unit. The load shall be maintained for at least 3 Sec. minimum without damage to the insulator or loosening of fitting. Insulators with broken whose metal parts are fractured or become detached during the test shall be rejected. If it exceeds 5 per cent of the lot, the lot shall be rejected.

21. ELECTRICAL TEST:

Post insulator unit shall be subjected to the power frequency. The test voltage shall be such as to produce frequent flashover (every few secs). The voltage shall be maintained for a minimum period of five minutes or if failures occur for five minutes after the last punctured piece has been removed. Insulators which are damaged during the test shall be rejected. Stream or pattern formed during electrical tests may be observable, but it shall not disqualify the insulator for acceptance.

SPECIFIC TECHNICAL REQUIREMENTS FOR POST INSULATORS

22. SCOPE :

The section covers the specific technical particulars, system particular suiting to which the post insulators shall be offered as per the General Technical Specifications given in Section-II of this specification and schedule of requirements specified herein

23. TYPE AND RATING :

The insulators offered shall be stacking type post insulator with cap and pedestal suitable for 220KV, 132KV, 33 KV system.

The insulators offered shall fulfil the following technical requirements: -

1. Type	Stacking type post pedestal Insulator with cap and pedestal	
2. System Earthing	Effectively Earthed.	
3. Rated system frequency	50 CPS	
4. Nominal system voltage in KV (RMS)	33	22
5. Highest system voltage in KV (RMS)	36	24
6. Basic insulation level in KVP	200	170
7. Minimum creepage distance in mm		
(i) Total	850	430
(ii) Protected	425	215
8. Cantilever strength in Kg.		
(i) Up right	3200	920
(ii) Inverted	1820	680

9. Tensile strength in Kg	9100	4500
10. Torsional strength in Kgfm	520	92
11. Height of each insulator (minimum) in mm	368	254
12. Bolt circle diameter in mm	127	76
13. Visible discharge test voltage (Power frequency) in KV (RMS)	27	18
14. One minute power frequency with stand test voltage in KV (RMS)		
(i) Dry	130	90
(ii) Wet	85	56
15. Impulse voltage with stand test voltage in KVP	210	125

Technical Particulars of 33KV Post Insulator's to be used in 132KV system Stacking Type

1.	Dimensions For 132 KV System	
(i)	Height of mm for each insulator	368
(ii)	Height of insulator stack in mm. (Solid core)	1472
(iii)	Bolt Circle Diameter in mm	127
(iv) Creepage distance in mm		
(a)	Total	3400
(b)	Protected	1700
(v) Cantilever strength in kg.		
(a)	Upright	550
(b)	Inverted	400
(vi)	Tensile strength in kg	9100
(vii)	Torsional strength	520
(viii)	Power Frequency flashover Voltage in KV (RMS)	275
(ix)	Impulse flash over in KV (peak)	750
(x)	Visible discharge Test Voltage power frequency in KV(rms)	105
(xi)	Number of Insulators to be used for stacking type	4 unit stack

CLAMPS AND CONNECTORS

GENERAL TECHNICAL REQUIREMENTS FOR CLAMPS AND CONNECTORS.

1. SCOPE

This section of the specification covers design, manufacture, testing at manufacturer's works before dispatch followed by supply and delivery of power connectors, bus bar, clamps etc for 132/33 KV line bay complete in all respects.

2. STANDARDS

The clamps, spacers and connectors covered under this specification shall conform strictly to the provisions of the following Indian Standard Specifications as amended up to date except where specified otherwise in the specification:

- a) IS: 5561-1970- Specification for electric power connector.
- b) IS:2121-1981- Specification for fitting for Aluminium as amended Part -I & II and Steel cored Aluminium conductors for overhead power lines. up-to-date
- c) IS:2633-1972- Methods for testing uniformity of coating on Zinc coated articles.
- d) IS:2629-1966- Recommended practice for hot dip galvanizing for Iron and Steel.
- e) IS:617-1975- Specification for Aluminium and Aluminium alloy materials.
- f) IS: 1963-1967- Specification for Steels.
- g) IS:1367-1961- Bolts and Nuts.

3. RATING

Normal current rating at the specified temperature of 50 degree C shall not be less than Current rating of moose conductor

The minimum rated Short Time Current rating shall be taken as 31.5 KA for 1 sec for 132 KV.

The connectors has to withstand the above current successfully for which test certificates from C.P.R.I, Bangalore or any other testing Laboratory recognized by Government has to be furnished with the tender. The current density to be considered in design shall not be more than 1.25-A per mm square.

4. MATERIAL:

All Aluminium and Aluminium alloy used in the manufacture shall conform to IS: 617- 1975 (as amended upto date).

All bolts, nuts & washers shall be made from non-magnetic stainless steel and shall have bright finish: The holes of plain washer shall be reasonably concentric with outer periphery. All sharp edges shall be removed. Spring washers shall be supplied in natural finish.

The materials offered shall be of best quality and workmanship, free of blow holes and cracks, well finished and of approved design. The materials used in manufacture of the clamps and connectors should have high current carrying capacity, high corrosion resistance. The purity and composition of the materials shall have to be indicated in the tender. All connectors or its components to be connected with ACSR conductors shall have Aluminium purity not less than 99.5% if these are compression type.

All bus bar clamp shall be made preferably from forged Aluminium of purity not less than 99.5%. The thickness and contact surface should be maintained in such way that the clamp should conform to IS:5561-1970 or any latest revision thereof.

Any terminal connector or its components other than those as mentioned above shall be manufactured from Aluminium Silicon alloy conforming to designation A6 of IS:617-1950 (latest version)

All ferrous metal parts except those made of stainless steel shall be protected by hot-dip galvanizing in accordance with IS:2629-1966, as amended up to date. Spring washer where used shall be electro galvanized. The thread in nuts and in tapped holes shall be cut before galvanizing and if required should be re-turned after galvanizing.

5. DESIGN AND CONSTRUCTION:

The connectors shall be designed and proportioned so that they are capable of safely withstanding the stresses to which they may be subjected including those due to short circuits (Dynamic Force upto 300 Kg during short circuit) and stresses, due to climatic conditions, wind load etc. The effect of vibration both on the conductor and connectors itself shall be minimum. The connectors shall be designed, manufactured and finished to avoid sharp radii of curvature, ridges, excrescences which might lead to localised pressure or damage to the conductor and connectors in service.

Supplier should provide Cold Rolled Aluminium Copper, bimetallic strip between the copper and Aluminium portion of the connection. The sheet thickness shall not be less than 2 mm.

Sufficient contact pressure should be maintained at the joint by provision of required number of bolts and nuts and other fixing arrangement. But the contact pressure should not be so great as to cause relaxation of the joint by cold flow. The joint should be such that the pressure is maintained within the range under all conditions of service. To avoid excessive local pressure, the contact pressure should be evenly distributed by use of pressure plates, washers or suitable saddles of adequate area and thickness.

The current carrying parts shall be designed and manufactured such that contact resistance is reduced to the minimum. The resistance of the joint should be less than that of an equal length of conductor when measured. Test Report showing the millivolt drop test and resistance should be enclosed with the tender.

All connectors shall be so designed and manufactured as to offer ease of installation as these are to be used in overhead installations. Design of the connector will be such that full tightening of nuts & bolts should be possible without the use of double wrench.

The connectors shall be such as to avoid local corona sound or visible discharge.

6. TEMPERATURE RISE:

The temperature rise of power connectors while carrying the rated current shall not exceed 35 degree C over the ambient temperature of 50 degree C prevailing in the substation site.

If the ambient temperature exceeds as specified above, the permissible temp rise shall be reduced by an amount equal to the excess ambient temperature.

7. TEST

Following acceptance tests and routine tests shall be carried out on the clamps & connectors as per IS:555C ~ 1 ~ c. IS:2633 in the works of manufacturer-.

a) Routine test:

- i) Visual Inspection test
- ii) Dimensional check

b) Acceptance test:

- i) Tensile test.
- ii) Resistance test
- iii) Dimensional check
- iv) Galvanising test

If type test has already been done & in case required by B.S.E.B, type test indicated below may also be performed for which Board may pay actual charges.

- i) Tensile test
- ii) resistance test
- iii) Temperature rise test.
- iv) Short time Current test.
- v) Salt spray test,
- vi) Galvanising test for Galvanised ferrous items.
- vii) Visual Corona discharge test
- viii) Dimensional test.

The reports of all the above mentioned tests carried out on each items shall be submitted for approval.

The Tenderers should have adequate testing facilities at their works to conduct all acceptance and routine tests as required by relevant ISS at their costs. The tenderer may have to arrange type testing of clamps/connectors before finalization of the tender at their cost.

Acceptance and routine test certificates as mutually agreed between the purchaser and the contractor based on any national standard will have to be furnished by the tenderer. These certificates will have to be got approved by the tenderer before supply of materials.

8. DRAWINGS:

Each tender shall be accompanied with four sets of detailed dimensional drawings of the connectors offered. The drawings should show the elevation, cross section, longitudinal-section and plan of each item, tendered. The materials of each part to be manufactured shall be clearly indicated in the drawing. All dimensions must be in metric units, Schedule of drawings must accompany the tender.

The successful tenderer will have to submit six sets of approved drawings and manuals for the use of the purchaser. Out of these sets, one set must be in the form of reproducible tracing.

Any manufacturing done prior to the approval of the drawings will be at the supplier's risk. The purchaser shall have the right to request the supplier to make any change in the design which may be necessary in his opinion to make the equipments conform to the stated provisions and intent of these specifications without additional cost to the purchaser.

9. INTERCHANGEABILITY

Corresponding parts of similar clamps & connectors shall be interchangeable in every respects.

10. INSTRUCTION BOOKS/ CATALOGUES:

Applicable parts list, catalogues, operating and maintenance instructions in English/Hindi language especially prepared to cover all the equipment supplied under this specification which may be needed for assembling, Disassembling, repairs, identification of parts for ordering replacements, operation and maintenance, shall be collected in a common cover and submitted in twelve copies for each equipment to the purchaser free of cost. Such instruction booklets shall be supplied at least two months before actual dispatch of the equipment.

11. SAMPLES:

The tenderer will have to submit sample of each item for approval to HURL before effecting supply and delivery of the ordered quantity of all items.

12. MARKING:

The equipment shall be eligibly and itidaliably marked with Trade mark of the manufacturer, country of manufacture and suitable identification mark as 13.S.E.Board.

All labels to be used on wooden boxes containing the clamp and connectors, shall be of tin securely bound with wire and shall have the descriptive marking stamped thereon.

13. SPECIFIC TECHNICAL PARTICULARS FOR THE CONNECTOR / P.G.CLAMPS / BUS SUPPORT CONNECTORS

1	Rated Current	Equivalent of current rating of Moose conductor
2	Rated frequency	50 Hz
3	Rated short time current	25 KA for 3 sec (minimum)
4	Aluminium Alloy to be used must conform to	IS617 :1975 (amended up to date)
5	Stainless steel Bolts & NUTs conforming to	IS 1363 : 1967 &IS 1367-1961 (as amended up to date)
6	Temp. rise of connectors and clamps above 50oC ambient temp. shall not exceed	35oC
7	Protection against corrosion	All parts shall either be inherently resistant atmospheric condition or suitably protected against corrosion both during storage and in service
8	Tensile Load Test	
	A) For connector	A tensile load of 55 kg shall be applied and the conductor shall be marked in such a way that movement relative to the connectors shall be tested
	B) For Tension clamps	without any subsequent adjustment on the connector, the load shall be steadily increased to 110Kg. This load shall be maintained for one minute. There shall be no movement of the conductor due to slip during this one minute period and no failure of the connector
9	Material	Forged Al. Alloy IS:617-1959 (As amended upto date)
10	Make of bolts & nuts.	Tested non magnetic stainless steel of required make

14. **OFFER FOR COMPRESSION TYPE JOINTS/CLAMPS & CONNECTOR**

Clamps and connectors may be fixed by means of hydraulic tools with suitable dies. These dies should be manufactured from heat treated alloy steel. Dies will be supplied in line with the sizes of the conductors to be used i.e., ACSR "Moose" and "Panther" conductors.

The clamps & connectors should be made of forged Al. alloy suitable to withstand the load and stresses. Conductivity should not be less than the same length of the conductor.

Moose conductor

TECHNICAL SPECIFICATIONS

1. Technical Description of ACSR 'MOOSE' Conductor

Details of Conductor

The ACSR Conductor shall generally conform to IEC: 1089 /IS: 398 (Part-V) except where otherwise specified herein.

The details of the ACSR MOOSE Conductor are tabulated below :

a)	Stranding and wire diameter	54/3.53 mm Aluminium +7/3.53mm steel
b)	Number of Strands	
	Steel core	1
	1st steel layer	6
	1st Aluminium layer	12
	2nd Aluminium layer	18
	3rd Aluminium layer	24
c)	Sectional area of Aluminium	528.5 sq. mm
d)	Total sectional area	597.0 sq. mm
e)	Overall diameter	31.77 mm
f)	Approximate mass	2004 (Kg/ KM)
g)	Calculated D.C. resistance at 20 deg. Centigrade	0.05552 Ohm/KM
h)	Minimum UTS	161.2 KN
i)	Direction of lay of outer layer	Right hand

The details of Aluminium strand are as follows:

a)	Minimum breaking load of strand before stranding	1.57 KN
b)	Minimum breaking load of strand after stranding	1.49 KN
c)	Maximum D.C. resistance of strand at 20	2.921 Ohm/KM

The details of steel strand are as follows :

a)	Minimum breaking load of strand before stranding	12.63 KN
b)	Minimum breaking load of strand after stranding (KN)	11.99 KN
c)	Minimum number of twists to be withstood in torsion test when tested on a gauge length of 100 times diameter of wire	18 (Before stranding) 16 (After stranding)

Workmanship

All the Aluminium and steel strands shall be smooth, uniform and free from all imperfections, such as spills and splits, die marks, scratches, abrasions, etc., after drawing and also after stranding.

The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protusion of wires), wire cross over, over riding, looseness (wire being dislocated by finger/hand pressure and/or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc.), dirt, grit etc.

The steel strands shall be hot dip galvanised and shall have a minimum zinc coating of 250 gms/sq.m. after stranding. The zinc coating shall be smooth, continuous, of uniform thickness, free from imperfections and shall withstand minimum two & a half dips in standard Preece test. The steel wire rods shall be of such quality and purity that, when drawn to the size of the strands specified and coated with zinc, the finished strands and the individual wires shall be of uniform quality and have the same properties and characteristics as prescribed in IEC : 888.

The steel strands shall be preformed and post formed in order to prevent spreading of strands in the event of cutting of composite core wire. Care shall be taken to avoid, damages to galvanisation during pre-forming and post-forming operation.

Joints in Wires

Aluminium Wires

During stranding, no aluminium wire welds shall be made for the purpose of achieving the required conductor length.

No joints shall be permitted in the individual wires in the outer most layer of the finished conductor. However joints are permitted in the 12 wire and 18 wire inner layer of the conductor unavoidably broken during stranding, provided such breaks are not associated

with either inherently defective wire or with the use of short lengths of aluminium wires. Such joints shall not be more than four (4) per conductor length and shall not be closer than 15 meters from joint in the same wire or in any other aluminium wire of the completed conductor.

Joints shall be made by cold pressure butt welding and shall withstand a stress of not less than the breaking strength of individual strand guaranteed.

Steel Wires

There shall be no joint of any kind in the finished wire entering into the manufacture of the strand. There shall also be no strand joints or strand splices in any length of the completed stranded steel core of the conductor.

Tolerances

The manufacturing tolerances to the extent of the following limits only shall be permitted in the diameter of individual aluminium and steel strands and lay-ratio of the conductor :

a) Diameter of Aluminium and Steel Strands

	<u>Standard</u>	<u>Maximum</u>	<u>Minimum</u>
Aluminium	3.53 mm	3.55 mm	3.51 mm
Steel	3.53 mm	3.59 mm	3.47 mm

b) Lay ratio of Conductor

		<u>Maximum</u>	<u>Minimum</u>
Steel	6 wire layer	18	16
Aluminium	12 wire layer	14	12
	18 wire layer	13	11
	24 wire layer	12	10

Materials

Aluminium

The aluminium strands shall be hard drawn from electrolytic aluminium rods having purity not less than 99.50% and a copper content not exceeding 0.04%. They shall have the same properties and characteristics as prescribed in IEC: 889.

Steel

The steel wirestrands shall be drawn from high carbon steel wire rods produced by either the acid or the basic open-hearth process, the electric furnace process, or the basic oxygen process and shall conform to the following requirements as to the chemical composition :

Element	% Composition
Carbon	0.50 to 0.85
Manganese	0.50 to 1.10
Phosphorous	Not more than 0.035
Sulphur	Not more than 0.045
Silicon	0.10 to 0.35

The Steel wire strands shall have the same properties and characteristics as prescribed for regular strength steel wire in IEC : 888-1987.

Zinc

The zinc used for galvanising shall be electrolytic High Grade Zinc of 99.95% purity. It shall conform to and satisfy all the requirements of IS:209.

Standard Length

The standard length of the conductor shall be 1800 meters. A tolerance of +/-5% on the standard length offered by the Bidder shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.

Random lengths will be accepted provided no length is less than 70% of the standard length and the total quantity of such random lengths shall not be more than 10% of the total quantity ordered. When one number random length has been manufactured at any time, eleven (11) more individual lengths each equivalent to the above random length with a tolerance of +/- 5% shall also be manufactured and all the above twelve random lengths shall be despatched in the same shipment. At no point, the cumulative quantity supplied of such random lengths shall not be more than 12.5% of the total cumulative quantity supplied including such random lengths. However, the last 20% of the quantity ordered shall be supplied only in standard lengths as specified.

Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars of offer. This is required for special stretches like river crossing etc. The Owner reserves the right to place orders for the above lengths on the same terms and conditions applicable for the standard lengths during the pendency of the Contract.

Tests and Standards

Type Tests

The following tests shall be conducted once on a sample of conductor :

- | | |
|---------------------------------------------|-------------------|
| a) DC resistance test on stranded conductor | As per Annexure-A |
| b) UTS test on stranded conductor | |
| c) Radio interference voltage test (dry) | |
| d) Corona extinction voltage test (dry) | |

Acceptance Tests

- | | |
|--------------------------------------------------------------------------------------------|-------------------|
| a) Visual and dimensional check on drum | As per Annexure-A |
| b) Visual check for joints scratches etc. and length measurement of conductor by rewinding | |
| c) Dimensional check on steel and aluminium strands | |
| d) Check for lay-ratios of various layers | |
| e) Galvanising test on steel strands | |
| f) Check for lay-ratios of various layers | |
| g) Torsion and Elongation tests on steel strands | |
| h) Breaking loadtest on steeland Aluminiumstrands | |
| i) Wrapttest on steel& Aluminium strands | IEC : 888 & 889 |
| j) DC resistance test on Aluminium strands | IEC : 889 |
| k) Procedure qualification test on welded joint of Aluminium strands | Annexure-A |

Note : All the above tests except (j) shall be carried out on aluminium and steel strands after stranding only.

Routine Test

- a) Check to ensure that the joints are as per Specification

- b) Check that there are no cuts, fins etc., on the strands.
- c) Check that drums are as per Specification
- d) All acceptance test as mentioned above to be carried out on each coil

Tests During Manufacture

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| <ul style="list-style-type: none"> a) Chemical analysis of zinc used for galvanizing b) Chemical analysis of Aluminium used for making Aluminium strands c) Chemical analysis of steel used for making steel strands | As per Annexure-A |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|

Testing Expenses

2.5.1 The break-up of the testing charges for the type tests specified shall be indicated separately.

Bidder shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities are available in the laboratories and the tests can be completed in these laboratories within the time schedule guaranteed by them.

In case of failure in any type test the Supplier is either required to manufacture fresh sample lot and repeat all the test successfully once or repeat that particular type test three times successfully on the sample selected from the already manufactured lot at his own expenses. In case a fresh lot is manufactured for testing then the lot already manufactured shall be rejected.

The entire cost of testing for the acceptance and routine tests and Tests during manufacture specified herein shall be treated as included in the quoted unit price of conductor, except for the expenses of the inspector/Owner's representative.

In case of failure in any type test, if repeat type tests are required to be conducted, then all the expenses for deputation of Inspector/Owner's representative shall be deducted from the contract price. Also if on receipt of the Supplier's notice of testing, the Owner's representative does not find material or test facilities to be ready for testing the expenses incurred by the Owner for re-deputation shall be deducted from contract price.

Additional Tests

The Owner reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier's premises, at site or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the materials comply with the Specifications.

The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test centre. In case of evidence of non compliance, it shall be binding on the part of Supplier to prove the compliance of the items to the technical specifications by repeat tests, or correction of deficiencies, or replacement of defective items all without any extra cost to the Owner.

Sample Batch For Type Testing

The Supplier shall offer material for selection of samples for type testing only after getting Quality Assurance Plan approved from Owner's Quality Assurance Deptt. The sample shall be manufactured strictly in accordance with the Quality Assurance Plan approved by Owner.

The Supplier shall offer at least three drums for selection of sample required for conducting all the type test.

The Supplier is required to carry out all the acceptance tests successfully in presence of Owner's representative before sample selection.

Test Reports

Copies of type test reports shall be furnished in at least six copies along with one original. One copy will be returned duly certified by the Owner only after which the commercial production of the material shall start.

Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Owner's representative.

Test Certificates of tests during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

Inspection

The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where conductor shall be manufactured and representative shall have full facilities for unrestricted inspection of the Supplier's works, raw materials and process of manufacture for conducting necessary tests as detailed herein.

The Supplier shall keep the Owner informed in advance of the time of starting and of the progress of manufacture of conductor in its various stages so that arrangements can be made for inspection.

No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested, unless the inspection is waived off by the Owner in writing. In the latter case also the conductor shall be dispatched only after satisfactory testing for all tests specified herein have been completed.

The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the Specification, and shall not prevent subsequent rejection if such material is later found to be defective.

Test Facilities

The following additional test facilities shall be available at the Supplier's works:

- a) Calibration of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
- b) Standard resistance for calibration of resistance bridges.
- c) Finished conductor shall be checked for length verification and surface finish on separate rewinding machine at reduced speed (variable from 8 to 16 meters per minute). The rewinding facilities shall have appropriate clutch system and free of vibrations, jerks etc. with traverse laying facilities.

Packing

The conductor shall be supplied in non-returnable, strong, wooden drums provided with lagging of adequate strength, constructed to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The Supplier shall be responsible for any loss or damage during transportation handling and storage due to improper packing. The drums shall generally conform to IS:1778, except as otherwise specified hereinafter.

The drums shall be suitable for wheel mounting and for letting off the conductor under a minimum controlled tension of the order of 5 KN.

The general outline of the drum for conductor shall be as in the annexed drawings. The Bidder should submit their proposed drum drawings along with the bid.

For conductor, one standard length shall be wound on each drum.

All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component parts of the drums. Preservative treatment shall be applied to the entire drum with preservatives of a quality which is not harmful to the conductor.

The flanges shall be of two ply construction with each ply at right angles to the adjacent ply and nailed together. The nails shall be driven from the inside face flange, punched and then clenched on the outer face. The thickness of each ply shall not vary by more than 3mm from that indicated in the figure. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75mm. Where a slot is cut in the flange to receive the inner end of the conductor the entrance shall be in line with the periphery of the barrel.

The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.

Barrel studs shall be used for the construction of drums. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing.

Normally, the nuts on the studs shall stand protruded of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be counter sunk. The ends of barrel shall generally be flushed with the top of the nuts.

The inner cheek of the flanges and drum barrel surface shall be painted with a bitumen based paint.

Before reeling, card board or double corrugated or thick bituminised water-proof bamboo paper shall be secured to the drum barrel and inside of flanges of the drum by means of a suitable commercial adhesive material. After reeling the conductor, the exposed surface of the outer layer of conductor shall be wrapped with water proof thick bituminised bamboo paper to preserve the conductor from dirt, grit and damage during transport and handling.

A minimum space of 75 mm for conductor shall be provided between the inner surface of the external protective tagging and outer layer of the conductor.

Each batten shall be securely nailed across grains as far as possible to the flange, edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nails shall not protrude above the general surface and shall not have exposed sharp edges or allow the battens to be released due to corrosion.

The nuts on the barrel studs shall be tack welded on the one side in order to fully secure them. On the second end, a spring washer shall be used.

A steel collar shall be used to secure all barrel studs. This collar shall be located between the washers and the steel drum and secured to the central steel plate by welding.

Outside the protective lagging, there shall be minimum of two binder consisting of hoop iron/galvanised steel wire. Each protective lagging shall have two recesses to accommodate the binders.

The conductor ends shall be properly sealed and secured on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling.

As an alternative to wooden drum Bidder may also supply the conductors in non-returnable painted steel drums. After preparation of steel surface according to IS:9954, synthetic enamel paint shall be applied after application of one coat of primer. Wooden/Steel drum will be treated at par for evaluation purpose and accordingly the Bidder should quote in the package.

Marking

Each drum shall have the following information stenciled on it in indelible ink alongwith other essential data:

- (a) Contract/Award letter number.
- (b) Name and address of consignee.
- (c) Manufacturer's name and address.
- (d) Drum number
- (e) Size of conductor
- (f) Length of conductor in meters
- (g) Arrow marking for unwinding
- (h) Position of the conductor ends
- (i) Distance between outer-most Layer of conductor and the inner surface of lagging.
- (k) Barrel diameter at three locations & an arrow marking at the location of the measurement.
- (l) Number of turns in the outer most layer.
- (m) Gross weight of drum after putting lagging.
- (n) Tear weight of the drum without lagging.
- (o) Net weight of the conductor in the drum.
- (p) CIP/MICC No.

The above should be indicated in the packing list also.

Verification of Conductor Length

The Owner reserves the right to verify the length of conductor after unreeling at least ten (10) percent of the drums in a lot offered for inspection.

Standards

The conductor shall conform to the following Indian/International Standards, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

In the event of the supply of conductor conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the standards proposed by the Supplier and those specified in this document will be provided by the Supplier to establish their equivalence.

Sl. No.	Indian Standard	Title	International Standard
1.	IS: 209-1992	Specification for zinc	BS:3436-1986
2.	IS: 398-1982	Specification for Aluminium Conductors for Overhead Transmission Purposes	IEC:1089-1991 BS:215-1970
3.	IS:398-1990 Part-II	Aluminum Conductor Galvanised Steel Reinforced	BS:215-1970 IEC:1089-1991
4.	IS:398-1992 Part-V	Aluminum Conductor Galvanised Steel-Reinforced For Extra High Voltage (400KV) and above	IEC:1089-1991 BS:215-1970
5.	IS : 1778-1980	Reels and Drums for Bare Conductors	BS:1559-1949
6.	IS : 1521-1991	Method of Tensile Testing of Steel Wire	ISO 6892-1984
7.	IS : 2629-1990	Recommended Practice for Hot Dip Galvanising of Iron and Steel	
8.	IS : 2633-1992	Method of Testing Uniformity of Coating on Zinc Coated Articles	
9.	IS : 4826-1992	Galvanised Coating on Round Steel Wires	IEC : 888-1987 BS:443-1969
10.	IS : 6745-1990	Methods of Determination of Weight of Zinc Coating of Zinc Coated Iron and Steel Articles	BS:433-1969 ISO 1460 - 1973
11.	IS : 8263-1990	Method of Radio Interference Tests on High Voltage Insulators	IEC:437-1973 NEMA:107-1964 CISPR
12.	IS : 9997-1988	Aluminium Alloy Redraw Rods	IEC 104 - 1987
13.		Zinc Coated steel wires for stranded Conductors	IEC : 888-1987
14.		Hard drawn Aluminium wire for overhead line conductors	IEC : 889-1987
15.	IS:398 (Part-IV)	Aluminium Alloy stranded conductor	IEC : 208-1966 BS-3242-1970

The standards mentioned above are available from:

Reference Abbreviation	Name and Address
BS	British Standards, British Standards Institution 101, Pentonville Road, N - 19-ND UK
IEC/CISPR	International Electro technical Commission, Bureau Central de la Commission, electro Technique international, 1 Rue de verembe, Geneva SWITZERLAND
BIS/IS	Beureau Of Indian Standards. Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi - 110001. INDIA
ISO	International Organisation for Standardization. Danish Board of Standardization Danish Standardizing Sraat, Aurehoegvej-12 DK-2900, Heelestrup, DENMARK.
NEMA	National Electric Manufacture Association, 155, East 44th Street. New York, NY 10017 U.S.A.

GUARANTEED TECHNICAL PARTICULARS FOR ACSR MOOSE CONDUCTOR

SL.NO.	DESCRIPTION	UNIT	GUARANTEED VALUES
1.0	Raw Materials		
1.1	Aluminium		
a)	Minimum purity of Aluminium	%	99.50
b)	Maximum Copper Content	%	0.04
1.2	Steel Wires/Rods		
a)	Carbon	%	0.50 to 0.85
b)	Manganese	%	0.50 to 1.10
c)	Phosphorous	%	Not more than 0.035
d)	Sulphur	%	Not more than 0.045
e)	Silicon	%	0.10 to 0.35 (max.)
1.3	Zinc		
a)	Minimum Purity of Zinc	%	99.95
2.0	Aluminium Strands after stranding		
2.1	Diameter		
a)	Nominal	mm	3.53
b)	Maximum	mm	3.55
c)	Minimum	mm	3.51
2.2	Minimum Breaking load of strand		
a)	Before Stranding	KN	1.57
b)	After Stranding	KN	1.49
2.3	Maximum resistance of 1 m length of strand at 20 deg C	Ohm	0.002921

3.0	Steel Strands after stranding		
3.1	Diameter		
a)	Nominal	mm	3.53
b)	Maximum	mm	3.59
c)	Minimum	mm	3.47
3.2	Minimum Breaking load of strand		
a)	Before Stranding	KN	12.63
b)	After Stranding	KN	11.99
3.3	Galvanising		
a)	Minimum weight of zinc coating per sq.m of uncoated wire surface after stranding	Gms.	250
b)	Minimum number of dips that the galvanized strand can withstand in the standard preece test	Nos.	2 of one minute and 1 of half minute
c)	Minimum number of twists in a gauge length equal to 100 times dia of wire which the strand can withstand in the torsion test after stranding	Nos.	16
4.0	ACSR Moose Conductor		
4.1	UTS of the conductor	KN	161.20 (Min)
4.2	Lay ratio of conductor		Max Min
a)	Outer 6 wire steel layer		18 16
b)	12 wire Aluminium layer		14 12
c)	18 wire Aluminium layer		13 11
d)	24 wire Aluminium layer		12 10
4.3	Max. DC resistance of conductor at 20 deg C	Ohm/Km	0.05552
4.4	Minimum corona Extinction voltage (Line to ground) (dry)	kV(rms)	320
4.5	RIV at 1 MHz at 305 kV (rms) under Dry condition	Microvolts	Below 1000
4.6	Standard length of conductor	M	1800

4.7	Tolerance on standard length of conductor	%	(+/-5)
4.8	Direction of lay for outside layer		Right Hand
4.9	Linear mass of conductor		
a)	Standard	Kg/km	2004
b)	Minimum	Kg/km	1969
c)	Maximum	Kg/km	2040

ANNEXURE-A

1. Tests on Conductor

UTS Test on Stranded Conductor

Circles perpendicular to the axis of the conductor shall be marked at two places on a sample of conductor of minimum 5 m length between fixing arrangement suitably fixed on a tensile testing machine. The load shall be increased at a steady rate upto 50% of minimum specified UTS and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter the load shall be increased at steady rate to minimum UTS and held for one minute. The Conductor sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

Corona Extinction Voltage Test

The samples of a bundle of four conductor of 5 m length shall be strung with spacing of 457 mm between them at a height not exceeding 8.84m above ground. The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than 320 kV (rms) line to ground under dry condition. There shall be no evidence of corona on any part of the samples. The test should be conducted without corona control rings. However, small corona control rings may be used to prevent corona in the end fittings. The voltage should be corrected for standard atmospheric conditions.

Radio Interference Voltage Test

Under the conditions as specified under (1.2) above, the conductor samples shall have radio interference voltage level below 1000 microvolts at one MHz when subjected to 50 Hz AC voltage of 305 kV line to ground under dry conditions. This test may be carried out with corona control rings and arcing horns.

D.C. Resistance Test on Stranded Conductor

On a conductor sample of minimum 5m length two contact-clamps shall be fixed with a

predetermined bolt torque. The resistance shall be measured by a Kelvin double bridge by placing the clamps initially zero metre and subsequently one metre apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20°C as per IS:398-(Part-V)-1982. The resistance corrected at 20°C shall conform to the requirements of this Specification.

Chemical Analysis of Aluminium and Steel

Samples taken from the Aluminium and steel ingots/coils/strands shall be chemically/spectrographically analysed. The same shall be in conformity to the requirements stated in this Specification.

Visual and Dimensional Check on Drums

The drums shall be visually and dimensionally checked to ensure that they conform to the requirements of this Specification.

Visual Check for Joints, Scratches etc.

Conductor drums shall be rewound in the presence of the Owner. The Owner shall visually check for scratches, joints etc. and that the conductor generally conform to the requirements of this Specification. Ten percent (10%) drums from each lot shall be rewound in the presence of the Owner's representative.

Dimensional Check on Steel and Aluminium Strands

The individual strands shall be dimensionally checked to ensure that they conform to the requirement of this Specification.

Check for Lay-ratios of Various Layers

The lay-ratios of various layers shall be checked to ensure that they conform to the requirements of this Specification.

Procedure Qualification test on welded Aluminium strands.

Two Aluminium wire shall be welded as per the approved quality plan and shall be subjected to tensile load. The breaking strength of the welded joint of the wire shall not be less than the guaranteed breaking strength of individual strands.

Chemical Analysis of Zinc

Samples taken from the zinc ingots shall be chemically/ spectrographically analysed. The same shall be in conformity to the requirements stated in the Specification.

Galvanising Test

The test procedure shall be as specified in IEC : 888. The material shall conform to the requirements of this Specification. The adherence of zinc shall be checked by wrapping around a mandrel four times the diameter of steel wire.

Torsion and Elongation Tests on Steel Strands

The test procedures shall be as per clause No. 10.3 of IEC : 888. In torsion test, the number of complete twists before fracture shall not be less than 16 on a length equal to 100 times the standard diameter of the strand. In case test sample length is less or more than 100 times the stranded diameter of the strand, the minimum number of twists will be proportioned to the length and if number comes in the fraction then it will be rounded off to next higher whole number. In elongation test, the elongation of the strand shall not be less than 4% for a gauge length of 250 mm.

Panther conductor

GENERAL TECHNICAL SPECIFICATION AND OTHER TERMS AND CONDITIONS FOR SUPPLY OF ACSR PANTHER CONDUCTOR

2.3.1 SCOPE:

This section of the specification covers the technical specification for design manufacture, testing and supply of ACSR PANTHER (Aluminium conductor galvanized steel reinforced) conductor for use in high voltage transmission lines.

2.3.2 DELETED.

2.3.3 STANDARD:

The design manufacture, galvanizing and testing of ACSR conductor against this tender shall conform to the following Indian standard specification as amended up to-date:-

- i) IS:390 (Part-II)- Specification for ACSR conductor for overhead Transmission purposes.
- ii) IS:2633-1966- recommended practice for hot dip galvanizing of iron & steel.
- iii) IS:2633-1972- Method for testing uniformity of coating on zinc coated articles.
- iv) IS:4826-1979-Specification for hot dipped galvanizer coatings on round steel wires.
- v) IS:6745-1972- Method for determination of Mass of Zinc Articles.
- vi) IS:209-Specification of Zinc.
- vii) IS:1778- Specification for Reels & Drums for Bare conductors.

2.3.4 TECHNICAL PARTICULARS:

The important technical requirements of ACSR conductor are enclosed in specific technical particulars.

2.3.5 QUANTITY:

The size and quantity of ACSR conductor proposed for procurement against this tender shall be furnished by the tenderer

2.3.6 MATERIAL AND WORKMANSHIP:

2.3.6.1 The material and workmanship will strictly conform to the requirement of IS:398 Part-II as amended up to date.

2.3.6.2 The individual wires as well as the stranded conductor shall be smooth as free from all imperfections as spills & splits. The steel wires shall be evenly and uniformly coated with zinc complying with IS:209.

2.3.7 RAW MATERIALS:

2.3.7.1 Procurement of all raw materials for manufacture and testing of ACSR conductor shall be arranged by the suppliers at their own cost. HURL will not be responsible for arranging raw materials. As such the rates quoted for supply of conductor shall include the cost of all raw materials. Any extension in delivery period shall not be allowed on pretext of non-availability or interest, will have to ensure to have adequate stock of all raw materials for complete supply.

2.3.7.2 The tenderers shall state in their tender the name of the maker's from where they propose to procure the raw materials. The supplier shall not procure any raw materials for the purpose of their tenders unless otherwise approved by the purchaser in written.

2.3.8 TEST DURING MANUFACTURE:

2.3.8.1 The individual wires as well as the finished ACSR conductor during manufacture shall be tested in accordance with the stipulation made in IS:398 part-II as amended up to date

Control & Relay Panel

SECTION: CONTROL AND RELAY PANELS

1. Protection Relay :

- 1.) Differential Protection Relay(87 L) : Siemens make numerical relay Type-7SD6101-6BB99-1BJ0+LOR+M2G (Single Mode)
- 2.) Feeder Protection Relay : Siemens make numerical relay Type-7SJ66-6KB90-1FG4+LOR
- 3.) Lockout Relay shall be VAJH type only.
- 4.) Trip Circuit supervision Relay shall be VAX type only.

2. TYPE OF PANELS

Simplex Panel

Simplex panel shall consist of a vertical front panel with equipment mounted thereon and having wiring access from rear for control panels & either front or rear for relay panels. In case of panel having width more than 800mm, double leaf-doors shall be provided. Doors shall have handles with either built-in locking facility or will be provided with pad-lock.

Duplex Panel

Duplex panel shall be walk-in tunnel type comprising two vertical front and rear panel sections connected back-on-back by formed sheet steel roof tie members and a central corridor in between. The corridor shall facilitate access to internal wiring and external cable connections. In case of number of duplex panels located in a row side by side, the central corridor shall be aligned to form a continuous passage. Both ends of the corridor shall be provided with double leaf doors with lift off hinges. Doors shall have handles either with built-in locking facility or shall be provided with pad-locks. Separate cable entries shall be provided for the front and rear panels. However, inter-connections between front and back panels shall be by means of inter panel wiring at the top of the panel.

3. CONSTRUCTIONAL FEATURES

Control and Relay HURL shall be of panels of simplex or duplex type design as indicated in bill of quantity. It is the responsibility of the Contractor to ensure that the equipment specified and such unspecified complementary equipment required for completeness of the protective/control schemes be properly accommodated in the panels without congestion and if necessary, provide panels with larger dimensions. No price increase at a later date on this account shall be allowed. However, the width of panels that are being offered to be placed in existing switchyard control rooms, should be in conformity with the space availability in the control room.

Panels shall be completely metal enclosed and shall be dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP-31 in accordance with IS: 2147.

Panels shall be free standing, floor mounting type and shall comprise structural frames completely enclosed with specially selected smooth finished, cold rolled sheet steel of thickness not less than 3 mm for weight bearing members of the panels such as base frame, front sheet and door frames, and 2.0mm for sides, door, top and bottom portions. There shall be sufficient reinforcement to provide level transportation and installation.

All doors, removable covers and panels shall be gasketed all around with synthetic rubber gaskets Neoprene/EPDM generally conforming with provision of IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh. Design, materials selection and workmanship shall be such as to result in neat appearance, inside and outside with no welds, rivets or bolt head apparent from outside, with all exterior surfaces true and smooth.

Panels shall have base frame with smooth bearing surface, which shall be fixed on the embedded foundation channels/insert plates. Anti vibration strips made of shock absorbing materials that shall be supplied by the contractor, shall be placed between panel & base frame.

Cable entries to the panels shall be from the bottom. Cable gland plate fitted on the bottom of the panel shall be connected to earthing of the panel/station through a flexible braided copper conductor rigidly.

Relay panels of modern modular construction would also be acceptable.

4. MOUNTING

All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for external connections. The equipment on front of panel shall be mounted flush.

Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices and are readily accessible without use of special tools. Terminal marking on the equipment shall be clearly visible.

The Contractor shall carry out cut out, mounting and wiring of the free issue items supplied by others which are to be mounted in his panel in accordance with the corresponding equipment manufacturer's drawings. Cut outs if any, provided for future mounting of equipment shall be properly blanked off with blanking plate.

The centre lines of switches, push buttons and indicating lamps shall be not less than 750mm from the bottom of the panel. The centre lines of relays, meters and recorders shall be not less than 450mm from the bottom of the panel.

The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise the top lines of all meters, relays and recorders etc. shall be matched.

No equipment shall be mounted on the doors.

At existing station, panels shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment (centre lines of switches, push buttons and other equipment) on the front of the panel.

5. PANEL INTERNAL WIRING

Panels shall be supplied complete with interconnecting wiring provided between all electrical devices mounted and wired in the panels and between the devices and terminal blocks for the devices to be connected to equipment outside the panels. When panels are arranged to be located adjacent to each other all inter panel wiring and connections between the panels shall be furnished and the wiring shall be carried out internally.

All wiring shall be carried out with 650V grade, single core, stranded copper conductor wires with PVC insulation. The minimum size of the multi-stranded copper conductor used for internal wiring shall be as follows:

- All circuits except current transformer circuits and voltage transfer circuits meant for energy metering - one 1.5mm sq. per lead.
- All current transformer circuits one 2.5 sq.mm lead.
- Voltage transformer circuit (for energy meters): Two 2.5 mm sq.perlead.

All internal wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters & troughs shall be used for this purpose.

Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panels running throughout the entire length of the panels.

Wire termination shall be made with solderless crimping type and tinned copper lugs , which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations.

Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit breaker or device shall be distinguished by the addition of red coloured unlettered ferrule.

Longitudinal troughs extending throughout the full length of the panel shall be preferred for inter panel wiring. Inter-connections to adjacent panel shall be brought out to a separate set of terminal blocks located near the slots of holes meant for taking the inter- connecting wires.

Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipments

6. TERMINAL BLOCKS

All internal wiring to be connected to external equipment shall terminate on terminal blocks.

Terminal blocks shall be 650 V grade and have 10 Amps. continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Markings on the terminal blocks shall correspond to wire number and terminal numbers on the wiring diagrams. All terminal blocks shall have shrouding with transparent unbreakable material.

Disconnecting type terminal blocks for current transformer and voltage transformer secondary leads shall be provided. Also current transformer secondary leads shall be provided with short circuiting and earthing facilities.

At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side

- All CT & PT circuits: minimum of two of 2.5mm Sq. copper.
- AC/DC Power Supply Circuits : One of 6mm Sq. Aluminium.
- All other circuits: minimum of one of 2.5mm Sq. Copper.

There shall be a minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate or panel side wall. Also the clearance between two rows of terminal blocks edges shall be minimum of 150mm.

Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal blocks is run in parallel and close proximity along each side of the wiring-duct to provide for convenient attachment of internal panel wiring. The side of the terminal block opposite the wiring duct shall be reserved for the Owner's external cable connections. All adjacent terminal blocks shall also share this field wiring corridor.

All wiring shall be provided with adequate support inside the panels to hold them firmly and to enable free and flexible termination without causing strain on terminals.

The number and sizes of the Owner's multi core incoming external cables will be furnished to the Contractor after placement of the order. All necessary cable terminating accessories such as gland plates, supporting clamps & brackets, wiring troughs and gutters etc. (except glands & lugs) for external cables shall be included in the scope of supply.

7. PAINTING

All sheet steel work shall be phosphated in accordance with the IS:6005 "Code of practice for phosphating iron and steel".

Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning.

Rust and scale shall be removed by pickling with dilute acid followed by washing with running water rinsing with a slightly alkaline hot water and drying.

After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying.

The phosphate coating shall be sealed with application of two coats of ready mixed, stoved type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved.

After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The second finishing coat shall be applied after inspection of first coat of painting. The exterior colour of paint shall be of a slightly different shade to enable inspection of the painting.

A small quantity of finished paint shall be supplied for minor touching up required at site after installation of the panels.

In case the bidder proposes to follow any other established painting procedure like electrostatic painting, the procedure shall be submitted for POWERGRID's review and approval.

8. MIMIC DIAGRAM

Coloured mimic diagram and symbols showing the exact representation of the system shall be provided in the front of control panels.

Mimic diagram shall be made preferably of anodised aluminium or plastic of approved fast colour material, which shall be screwed on to the panel and can be easily cleaned. Painted overlaid mimic is also acceptable. The mimic bus shall be 2mm thick. The width of the mimic bus shall be 10mm for bus bars and 7mm for other connections.

Mimic bus colour will be decided by the BSPTCL and shall be furnished to the successful Bidder during Engineering.

When semaphore indicators are used for equipment position they shall be so mounted in the mimic that the equipment close position shall complete the continuity of mimic.

Indicating lamp, one for each phase, for each bus shall be provided on the mimic to indicate bus charged condition

9. NAME PLATES AND MARKINGS

All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved. Also on the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/feeder designation.

All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.

Each instrument and meter shall be prominently marked with the quantity measured e.g. KV, A, MW, etc. All relays and other devices shall be clearly marked with manufacturer's name, manufacturer's type, serial number and electrical rating data.

Name Plates shall be made of non-rusting metal or 3 ply lamicoid. Name plates shall be black with white engraving lettering.

Each switch shall bear clear inscription identifying its function e.g. 'BREAKER'52A', 'SYNCHRONISING' etc. Similar inscription shall also be provided on each device whose function is not other-wise identified. If any switch device does not bear this inscription separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indication e.g. "Trip- Neutral- Close", "ON-OFF", "R-Y-B-OFF" etc

All the panels shall be provided with name plate mounted inside the panel bearing LOA No & Date, Name of the Substation & feeder and reference drawing number.

10. MISCELLANEOUS ACCESSORIES

Plug Point : 240V, Single phase 50Hz, AC socket with switch suitable to accept 5 Amps and 15 Amps pin round standard Indian plug, shall be provided in the interior of each cubicle with ON-OFF switch.

Interior Lighting : Each panel shall be provided with a fluorescent lighting fixture rated for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel controlled by the respective panel door switch. Adequate lighting shall also be provided for the corridor in Duplex panels.

Switches and Fuses: Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with **Fuses**. Selection of the main and sub-circuit **Fuses** rating shall be such as to ensure selective clearance of sub-circuit faults. Voltage transformer circuits for relaying and metering shall be protected by fuses. All fuses shall be HRC cartridge type conforming to IS: 13703 mounted on plug-in type fuse bases. **The short time fuse rating of Fuses shall be not less than 9 KA.** Fuse carrier base shall have imprints of the fuse 'rating' and 'voltage'.

Space Heater : Each panel shall be provided with a **thermostatically connected** space heater rated for 240V, single phase, 50 Hz AC supply for the internal heating of the panel to prevent condensation of moisture. The fittings shall be complete with switch unit.

11. EARTHING

All panels shall be equipped with an earth bus securely fixed. Location of earth bus shall ensure no radiation interference for earth systems under various switching conditions of isolators and breakers. The material and the sizes of the bus bar shall be at least 25 X 6 sq.mm perforated copper with threaded holes at a gap of 50mm with a provision of bolts and nuts for connection with cable armours and mounted equipment etc for effective earthing. When several panels are mounted adjoining each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply of Contractor. Provision shall be made for extending the earth bus bars to future adjoining panels on either side.

Provision shall be made on each bus bar of the end panels for connecting Substation earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply of Contractor.

All metallic cases of relays, instruments and other panel mounted equipment including gland plate, shall be connected to the earth bus by copper wires of size not less than 2.5 sq. mm. The colour code of earthing wires shall be green.

Looping of earth connections which would result in loss of earth connection to other devices when the loop is broken, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be provided. VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system for other groups.

12. INDICATING INSTRUMENTS, RECORDERS & TRANSDUCERS

All instruments, meters, recorders and transducers shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. All megawatt, megavar, Bus voltage and frequency indicating instruments shall be provided with individual transducers and these shall be calibrated along with transducers to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have means of calibration check and adjustment at site. The supplier shall submit calibration certificates at the time of delivery. However no separate transducers are envisaged for digital bus voltmeters and digital frequency meters and the indicating meters provided in the synchronising equipment.

Indicating Instruments

Unless otherwise specified, all electrical indicating instruments shall be of digital type suitable for flush mounting.

Instruments shall have 4-digit display; display height being not less than 25 mm

Instrument shall conform to relevant IS and shall have an accuracy class of 1.5 or better. Watt and Var meters shall have an indication of (+) and (-) to indicate EXPORT and IMPORT respectively.

Digital voltage and frequency meters shall be of class: 0.5 and shall have digital display of 5 and 4 digits respectively, with display size, not less than 25mm (height).

13. ANNUNCIATION SYSTEM

Alarm annunciation system shall be provided in the control BSPTCL by means of visual and audible alarm in order to draw the attention of the operator to the abnormal operating conditions or the operation of some protective devices. The annunciation equipment shall be suitable for operation on the voltages specified in this specification.

The visual annunciation shall be provided by annunciation facia, mounted flush on the top of the control panels.

The annunciator facia shall be provided with translucent plastic window for alarm point with approximate size of 35mm x 50mm. The facia plates shall be engraved in black lettering with respective inscriptions. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall not be less than 5 mm.

Each annunciation window shall be provided with two white lamps in parallel to provide safety against lamp failure. Long life lamps shall be used. The transparency of cover plates and wattage of the lamps provided in the facia window shall be adequate to ensure clear visibility of the inscriptions in the control room having high illumination intensity (350 Lux), from the location of the operator's desk.

All Trip facia shall have red colour and all Non-trip facia shall have white colour.

The audible alarm shall be provided by Buzzer/ Hooter /Bell having different sounds and shall be used as follows.

Hooter	Alarm Annunciation
Bell	Annunciation DC failure
Buzzer	AC supply failure

Sequence of operation of the annunciator shall be as follows :

Sl. No.	Alarm Condition	Fault Contact	Visual Annunciation	Audible Annunciation
1.	Normal	Open	OFF	OFF
2.	Abnormal	Close	Flashing	ON
3.	Accept Push Button Pressed	Close	Steady ON	
4.	Reset Push Button Pressed	Close	OFF	OPEN
5.	Lamp Test Push Button Pressed	Open	Steady ON	OFF

Audible annunciation for the failure of DC supply to the annunciation system shall be provided and this annunciation shall operate on 240 Volts AC supply. On failure of the DC to the annunciation system for more than 2 or 3 seconds. (adjustable setting), a bell shall sound. A separate push button shall be provided for the cancellation of this audible alarm alone but the facia window shall remain steadily lighted till the supply to annunciation system is restored .

A separate voltage check relay shall be provided to monitor the failure of supply (240V AC) to the scheme mentioned in Clause above. If the failure of supply exists for more than 2 to 3 seconds. this relay shall initiate visual and audible annunciation. Visual and audible annunciation for the failure of AC supply to the annunciation system shall be provided and this annunciation shall operate on Annunciation DC and buzzer shall sound.

The annunciation system described above shall meet the following additional requirements :

- a) The annunciation system shall be capable of catering to at least 20 simultaneous signals at a time.
- b) One set of the following push buttons shall be provided on each control panel:
 - Reset push button for annunciation system.
 - Accept push button for annunciation system.
 - Lamp test push button for testing the facia windows
- c) One set of the following items shall be provided common for all the control panel (not applicable for extension of substation) :
 - Flasher relay for annunciation system.
 - Push button for Flasher test .
 - Three Push buttons for test of all audible alarm systems
- d) These testing circuits shall be so connected that while testing is being done it shall not prevent the registering of any new annunciation that may land during the test
- e) The annunciation shall be repetitive type and shall be capable of registering the fleeting signal. Minimum duration of the fleeting signal registered by the system shall be 15 milli seconds.
- f) In case of static annunciator scheme, special precaution shall be taken to ensure that spurious alarm condition does not appear due to influence of external electromagnetic/ electrostatic interference on the annunciator wiring and switching disturbances from the neighbouring circuits within the panels and the static annunciator shall meet the high voltage susceptibility test , impulse voltage with stand test , high frequency disturbance test– class III and fast transient disturbance test –level III as per IEC 60255.

The annunciation system to be supplied for existing sub-stations shall be engineered as an extension to the existing scheme.

14. SWITCHES

Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show operating position and circuit designation plates and suitable for flush mounting with only switch front plate and operating handle projecting out.

The selection of operating handles for the different types of switches shall be as follows :

Breaker, Isolator control switches	: Pistol grip, black
Synchronizing switches	: Oval, Black, Keyed handle (one common removable handle for a group of switches or locking facility having common key)
synchronizing Selector switches	: Oval or knob, black
Instrument switches	: Round, knurled, black
Protection Transfer switch	: Pistol grip, lockable and black.

The control switch of breaker and isolator shall be of spring return to neutral type. The switch shall have spring return from close and trip positions to "after close" and "after trip" positions respectively.

Instrument selection switches shall be of maintained contact (stay put) type.

4. INDICATING LAMPS

Indicating lamps shall be of cluster LED type suitable for panel mounting with rear terminal connections. Lamps shall be provided with series connected resistors preferably built in the lamp assembly. Lamps shall have translucent lamp covers to diffuse lights coloured red ,green, amber ,clear white or blue as specified .The lamp cover shall be preferably of screwed type ,unbreakable and moulded from heatresisting material.

The lamps shall be provided with suitable resistors .

Lamps and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools ,if required for replacing the bulbs and lenses shall also be included in the scope of the supply.

The indicating lamps with resistors shall withstand 120% of rated voltage on a continuous basis.

15. POSITION INDICATORS

Position indicators of "SEMAPHORE" type shall be provided when specified as part of the mimic diagrams on panels for indicating the position of circuit breakers, isolating/earthing switches etc. The indicator shall be suitable for semi-flush mounting with only the front disc projecting out and with terminal connection from the rear. Their strips shall be of the same colour as the associated mimic.

Position indicator shall be suitable for DC Voltage as specified. When the supervised object is in the closed position, the pointer of the indicator shall take up a position in line with the mimic bus bars, and at right angles to them when the object is in the open position. When the supply failure to the indicator occurs, the pointers shall take up an intermediate position to indicate the supply failure.

The rating of the indicator shall not exceed 2.5 W.

The position indicators shall withstand 120% of rated voltage on a continuous basis.

17. RELAYS (SIEMENS make only)

All relays shall conform to the requirements of IEC 61850 protocol or other applicable standards. Relays shall be suitable for flush or semi-flush mounting on the front with connections from the rear.

All protective relays shall be in draw out or plug-in type/modular cases with proper testing facilities. Necessary test plugs/test handles shall be supplied loose and shall be included in contractor's scope of supply.

All AC operated relays shall be suitable for operation at 50 Hz. AC Voltage operated relays shall be suitable for 110 Volts VT secondary and current operated relays for 1 amp CT secondary. All DC operated relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.

The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification. Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts suiting contact duties of protective relays and monitoring of control supplies and circuits, lockout relay monitoring circuits etc. also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme, contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relay coils and contacts, including spare contacts.

All protective relays, auxiliary relays and timers except the lock out relays and interlocking relays specified shall be provided with self-reset type contacts. All protective relays and timers shall be provided with externally hand reset positive action operation indicators with inscription. All protective relays which do not have built-in hand-reset operation indicators shall have additional auxiliary relays with operating indicators (Flag relays) for this purpose. Similarly, separate operating indicator (auxiliary relays) shall also be provided in the trip circuits of protections located outside the BSPTCL such as Buchholz relays, oil and winding temperature protection, sudden pressure devices, fire protection etc.

Timers shall be of the electromagnetic or solid state type. Pneumatic timers are not acceptable. Short time delays in terms of milliseconds may be obtained by using copper slugs on auxiliary relays. In such case it shall be ensured that the continuous rating of the relay is not affected. Time delay in terms of milliseconds obtained by the external capacitor resistor combination is not preferred and shall be avoided to the extent possible.

No control relay which shall trip the power circuit breaker when the relay is de-energised shall be employed in the circuits.

Provision shall be made for easy isolation of trip circuits of each relay for the purpose of testing and maintenance.

All protective relays and alarm relays shall be provided with one extra isolated pair of contacts wired to terminals exclusively for future use.

The setting ranges of the relays offered, if different from the ones specified shall also be acceptable if they meet the functional requirements.

The bidder shall include in his bid a list of installations where the relays quoted have been in satisfactory operation.

All relays and their drawings shall have phase indications as R-Red, Y- yellow, B-blue

18. TRANSMISSION LINE PROTECTION

The line protection relays are required to protect the line and clear the faults on line within shortest possible time with reliability, selectivity and full sensitivity to all type of faults on lines. The general concept is to have two main protections having equal performance requirement specially in respect of time as called Main-I and Main-II for 132 KV lines.

The Transmission system for which the line protection equipment are required is detailed in specification. The length of lines and the line parameters (Electrical Constants) are also indicated there.

The maximum fault current could be as high as 40 kA but the minimum fault current could be as low as 20% of rated current of CT secondary. The starting & measuring relays characteristics should be satisfactory under these extremely varying conditions.

20. LINE OVER VOLTAGE PROTECTION RELAY shall

- (a) monitor all three phases
- (b) have two independent stages and stage- I & II relay are acceptable as built in with line distance relays Main I & II respectively.
- (c) have an adjustable setting range of 100-170% of rated voltage with an adjustable time delay range of 1 to 60 seconds for the first stage.
- (d) have an adjustable setting range of 100-170% of rated voltage with a time delay of 100-200 mill seconds for the second stage.

- (e) be tuned to power frequency
- (f) provided with separate operation indicators (flag target) for each stage relays.
- (g) have a drop-off to pick-up ratio greater than 95%.
- (h) provide separate out-put contacts for each 'Phase' and stage for breaker trip relays, event logger and other scheme requirements.

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WEATHER PROOF RELAY PANELS

- (a) This panel shall include necessary number of electrically reset relays each with at least eight contacts for isolator auxiliary contacts multiplication and for changing the CT and DC circuits to relevant zones of bus bar protection.
- (b) The panel shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be at least 2.0 mm thick and properly braced to prevent wobbling.
- (c) The enclosures of the panel shall provide a degree of protection of not less than IP-55 (as per IS:2147).
- (d) The panel shall be of free standing floor mounting type or pedestal mounting type as per requirement.
- (e) The panel shall be provided with double hinged doors with padlocking arrangement.
- (f) All doors, removable covers and panels shall be gasketed all around with synthetic rubber gaskets Neoprene/EPDM generally conforming with provision of IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh
- (g) Cable entries shall be from bottom. Suitable removable cable gland plate shall be provided on the cabinet for this purpose.
- (h) All sheet steel work shall be degreased, pickled, phosphated and then applied with two coats of zinc chromates primer and two coats of finishing synthetic enamel paint, both inside and outside. The colour of the finishing paint shall be light grey in accordance with shade no.697 of IS:5.
- (i) Suitable heaters shall be mounted in the panel to prevent condensation. Heaters shall be controlled by thermostats so

that the cubicle temperature does not exceed 30°C. On-off switch and fuse shall be provided. Heater shall be suitable for 240V AC supply Voltage.

- (j) The test terminal blocks (TTB) to be provided shall be fully enclosed with removable covers and made of moulded, non-inflammable plastic material with boxes and barriers moulded integrally. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. Terminal block shall have shorting, disconnecting and testing facilities for CT circuits.

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LINE PROTECTION PANEL

The Line Protection panel for transmission lines shall consist of following relays and protection schemes

- (a) Two Separate Relays dedicatedly each for Line Differential & Line/Feeder Protection(Backup Protection) Relay .
- (b) Overvoltage Protection
- (c) Undervoltage Protection
- (d) Earth Fault (Directional & Non-Directional)
- (e) Overcurrent Protection (IDMT, DMT) (Directional & Non-Directional)
- (f) Over Frequency and Under Frequency
- (g) Inter-tripping,
- (h) Differential Protection
- (i) Breaker Failure
- (j) Goose Communication
- (k) monitor all three phases
- (l) Reverse Power & Forward Power
- (m) have two independent stages and stage- 1 & II relay
- (n) have an adjustable setting range of 100-170% of rated voltage with an adjustable time delay range of 1 to 60 seconds for the first stage.
- (o) have an adjustable setting range of 100-170% of rated voltage with a time delay of 100-200 mill seconds for the second stage.
- (p) be tuned to power frequency
- (q) provided with separate operation indicators (flag target) for each stage relays.
- (r) have a drop-off to pick-up ratio greater than 95%.
- (s) provide separate out-put contacts for each 'Phase' and stage for breaker trip relays, event logger and other scheme requirements.

POWER & CONTROL CABLES

1. POWER & CONTROL CABLES [FOR WORKING VOLTAGES UP TO AND INCLUDING 1100 V] (Reputed manufacturer)

CRITERIA FOR SELECTION OF POWER & CONTROL CABLES

1.1.1. Aluminium conductor XLPE insulated armoured cables shall be used for main power supply purpose from LT Aux. Transformers to control room, between distribution HURLs and for supply for colony lighting from control room.

Aluminium conductor PVC insulated armoured power cables shall be used for various other applications in switchyard area/control room except for control/protection purposes.

For all control/protection/instrumentation purposes PVC insulated armoured control cables of minimum 2.5 sq. mm. size with stranded Copper conductors shall be used.

Cables shall be laid conforming to IS : 1255.

While preparing cable schedules for control/protection purpose following shall be ensured:

Separate cables shall be used for AC & DC.

Separate cables shall be used for DC1 & DC2.

For different cores of CT & CVT separate cable shall be used

TECHNICAL REQUIREMENTS

PVC Control Cables

The PVC (**70°C**) *insulated* control cables shall be of FR type C1 category conforming to IS: 1554 (Part-1) and its amendments, read alongwith this specification. The conductor shall be stranded copper. The insulation shall be extruded PVC to type A of IS: 5831. A distinct inner sheath shall be provided in all cables whether armoured or not. The over sheath shall be extruded PVC to type ST-1 of IS: 5831 and shall be grey in colour .

Cores shall be identified as per IS: 1554 (Part-1) for the cables up to five (5) cores and for cables with more than five (5) cores the identification of cores shall be done by printing legible Hindu Arabic Numerals on all cores as per clause 10.3 of IS 1554 (Part-1).

Following type tests (*on one size in a contract*) as per IS: 1554 (Part 1) - 1988 including its amendments shall be carried out *as a part of acceptance tests* on PVC insulated *power & control* cables *for working voltages up to and including 1100 V*:

- a) Physical tests for insulation and outer sheath
 - i) Shrinkage test
 - ii) Hot deformation
 - iii) Heat shock test
 - iv) Thermal stability
- b) High voltage test (water immersion test only a.c. test as per clause no. 16.3.1)

(1.1 kV GRADE PVC)

CUSTOMER :		ROL CABLES) BSP TCL							
SN	Name of manufacturer :	As per approved list							
	Cable Sizes	2c x 2.5	3c x 2.5	5c x 2.5	7c x 2.5	10c x 2.5	14c x 2.5	19c x 2.5	27c x 2.5
1	Manufacturer's type designation	Y	W	Y	W	Y	W	Y	W
2	Applicable standard	IS: 1554/PT-V1988 & its referred standards							
3	Rated Voltage(volts)	1100							
4	Type & Category	FR & C1							
5	Suitable for earthed or unearthed system	for both							
6	Continuous current rating when laid in air in a ambient temp.of 50°C and for maximum conductor temp. of 70°C of PVC	22	19	19	14	12	10.5	9.7	8
7	Rating factors applicable to the current ratings for various conditions of installation:	As per IS-3961-Pt-II-67							
8	Short circuit Capacity								
	a) Short Circuit Amp. (rms)KA for 1 sec-for information only	0.285	0.285	0.285	0.285	0.285	0.285	0.285	0.285
	b) Conductor temp. allowed for the short circuit duty (deg C.)	160 °C							
9	Conductor								
	a) Material	Plain annealed High Conductivity stranded Copper (as per IS 8130/84)							
	b) Grade	Electrolytic							
	c) Cross Section area (Sq.mm.)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	d) Number of wires(No.)	as per Table 2 of IS 8130							
	e) Form of Conductor	Non-Compacted stranded circular conductor							
	f) Direction of lay of stranded layers	Outermost layer shall be R.H lay							
10	Conductor resistance (DC) at 20 °C per km(maxm)	7.41	7.41	7.41	7.41	7.41	7.41	7.41	7.41
11	Insulation								
	a) Composition of insulation	Extruded PVC type A as per IS-5831-84							
	b) Nominal thickness of insulation(mm)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	c) Minimum thickness of insulation	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
12	Inner Sheath								
	a) Material	Extruded PVC type ST-I as per IS-5831-84							
	b) Calculated diameter over the laid up cores.(mm)	7.2	7.8	9.7	10.8	14.4	15.9	18	22.1
	c) Thickness of Sheath (minimum)mm	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
13	Armour	as per IS 3975/99							
	a) Type and material of armour	Gal.	Gal.	Gal.	Gal.	Gal.	Gal.	Gal.	Gal. Steel
	b) Direction of armouring	left hand							

	c) Calculated diameter of cable over inner sheath (under armour) as per manufacturer design data	:	7.8	8.4	10.3	11.4	15	16.5	18.6	22.7
	d) Nominal diameter of round armour wire / dimensions of armour strip	:	1.4	1.4	1.4	1.4	1.6	1.6	1.6	1.6
	e) Number of armour wires	:	-----Armouring shall be as close as practicable-----							
	f) Short circuit capacity of the armour and duration-for info only	:	--0.05 x A t (K Amp)(where A = total area of armour in mm²& t = time in seconds)---							
	g) DC resistance at 20 °C (Ω/Km) & Resistivity of armour	:	-----As per IS 1554 Part(1), wherever applicable & IS 3975-1999-----							
14	Outer Sheath									
	a) Material (PVC Type)	:	ST-1& FR ST-1& FR ST-1& FR ST-1& FR ST-1& FR ST-1& FR ST-1& FR ST-1&							
	b) Calculated diameter under the sheath	:	10.6	11.2	13.1	14.2	18.2	19.7	21.8	25.9
	c) Min.thickness of sheath(mm)	:	1.24	1.24	1.24	1.24	1.4	1.4	1.4	1.56
	d) Guaranteed value of minimum oxygen index of outer sheath	:	Min 29.0 Min 29.0 Min 29.0 Min 29.0 Min 29.0 Min 29.0 Min 29.0 Min							
	e) Guranteed value of minimum temperature index at 21 oxygen index	:	Min 250 Min 250 Min 250 Min 250 Min 250 Min 250 Min 250 Min							
	f) colour of sheath	:	Grey	Grey	Grey	Grey	Grey	Grey	Grey	Grey
15	a) Overall diameter of cable	:	\$							
	b) Tolerance on overall diameter (mm)	:	-----+2/-2 mm-----							
16	Cable Drums	:	-----shall conform to IS 10418 and technical specification							
	a) Max./ Standard length per drum for each size of cable (:	1000/500 1000/500 1000/500 1000/500 1000/500 1000/500 1000/500							
	b) Non standard drum lengths	:	Maximum one(1) non standard lengths of each cable size may be supplied in drums only over & above the standard lengths as specified above.(if required for completion of project).							
17	Whether progressive sequential marking on outer sheath provided	:	: ----- YES -----							
18	Identification of cores	:								
	a) colour of cores	:	R & Bk	R,Y & BIR,Y,BI,Bk&	Grey	Grey	Grey	Grey	Grey	
	b) Numbering	:	Numeral Numeral Numeral Numeral Numerals							
19	Whether Cables offered are ISI marked	:	: ----- YES -----							
20	Whether Cables offered are suitable for laying as per IS 1255	:	: ----- YES -----							

Lighting system

1 LIGHTING SYSTEM

The scope of work comprises of design, engineering, testing, supply, installation, testing and commissioning of various lighting fixtures complete with lamps, supports and accessories lighting panels, lighting poles complete with distribution boxes, galvanised rigid steel conduits, lighting wires, G.I. Earthwire, receptacles, tag block & telephone socket, switch HURLs, switches, junction boxes, pull out boxes complete with accessories, lighting transformer. **All light fittings shall be LED type.**

SYSTEM DESCRIPTION

The lighting system shall comprise of the following :

AC Normal Lighting

AC lights will be connected to AC lighting panels. All the lights connected to the AC lighting system in different areas will be connected to the main lighting distribution HURLs.

AC Emergency Lighting

This system will be available in control room building, Fire fighting pump house ,DG Set building & switchyard. AC lighting load will be connected to this system which will be normally „ON“. The lighting panels of this system will be connected to the Emergency lighting HURL. which is fed from diesel generator during the emergency. 50% of lighting fixtures shall be connected on AC emergency lighting.

D.C. Emergency lighting

A few DC emergency lighting fixtures operated on the DC system will be provided in the strategic locations including staircase, corridors, electrical rooms, Battery charger room, LT switchgear room in control room building, Fire fighting pump house and DG Set building so that the operating personnel can safely find their way even during emergency of a total AC failure. These lights will be normally 'OFF' and will be switched 'ON' automatically when under voltage occurs in the AC main lighting distribution HURL. GLS lamp down lighters in false ceiling area and Bulkhead fixtures in non false ceiling area to be used.

Portable Fixtures

Three numbers of battery operated, portable fixtures will be provided in the Control room building and one number shall be provided in DG Set Building Cum Fire fighting pump house.

These fixtures will be provided at important locations in the above mentioned areas.

1.3 The lighting layout for and around Control Room Cum Administrative Office Building & DG House indicating the type & BOQ for various items shall be furnished by tenderers

The lux levels to be maintained in the switchyard shall be as per following:

Sl.No	Area	Average Lux Level
i)	Switchyard	-50 lux on main Equipments(i.e, Transformer, Reactor ISO,CB,CT,CVT,SA) at first level (Equipment connections level.) -20 lux on balance area of switchyard and street / Road at ground level

The minimum lux level to average lux level ratio should not be less than 0.3 (i.e $E_{min}/E_{av} > 0.3$).

The maintenance factor for outdoor illumination design shall be considered as 0.65.

For achieving the specified lux levels in the switchyard, the contractor can provide luminaries of 1x400 W/1x250 W and 2x400 W/ 2x250 W flood light as per requirement.

The contractor shall submit detailed calculation for reaching the above Lux level. Contractor shall conform the Lux levels at different locations of the switch yard and street lighting by measurement.

In addition to the normal lighting provided in the switchyard area to maintain the desired lux levels, few high beam fixtures on swivel support shall be provided in strategic locations near equipments which shall be kept normally OFF and these shall be switched ON in case of maintenance work.

1.7 For Outdoor Illumination

The switchyard and street lighting design, detailed drawings showing the lighting layout and Electrical distribution diagram shall be prepared by the Contractor and submitted for approval. The above layout drawings will include disposition and location of lighting fixtures, receptacles, etc.

All wiring including telephone wiring (tinned two pair copper) shall be in concealed conduit

2. DESCRIPTION OF ITEMS

The Contractor shall and install the following equipment and accessories in accordance with the specification.

LIGHTING PANELS

OUTDOOR

415 AC lighting panel with 415V, 63A, 3 phase 4 wire bus and one no. 63A, TPN, MCB with neutral unit as incomer and 20A, MCB as outgoing feeders, the details are as follows:

Type Description Details of outgoing feeders) ACP-2 Outdoor 6 nos.-20 A single pole MCB and 3 No. 32 A Tripple pole MCB with Neutral and suitable timer and contactor for automatic switching.

ACP-3 Outdoor street lighting 3 nos. 32A Triple pole MCB panel with Neutral with suitable timer and contactor for automatic switching

Note: The number of outgoing feeders indicated above are the minimum.

220V DC indoor type change over HURL and 220V DC 32A two wire bus and one 32A contractor backed up by 32A double pole MCB as incomer. The panel shall have local push button controls. Following are the various types of panels required with control timer.

Type Description Details of outgoing feeders) DCP Indoor 6 nos.-16A DP MCB unitSub-Lighting Panel

Type Description ...

SLP 4 pole 32A Isolator suitable for 415V, 50 cycles AC supply, with LILO facility using 8 nos terminal blocks suitable for cable upto 16 mm sq cable

Enclosure shall be suitable for outdoor use with IP-55 degree of protection as per IS:13947 (Part-1).

Lighting Fixtures and Receptacles

Lighting Fixtures Description

SC 150W SON-T Tubular Sodium Vapour lamp in street lighting luminaire. A special optical reflector clear acrylic cover, a single piece die cast aluminium housing made out of LM6 and corrosion resistance proof. Similar to Philips Cat No. SRX- 51 and Bajaj Cat No. BJMSDT/150 / Crompton Greaves Cat No. SSG 23151H .(Street Light Luminaire should be suitable for Bottom Entry/Side entry both for pipe mounting)

FI 2x36W fluorescent lamps in industrial reflector type fixture, complete with accessories and suitable for pendent Mounting, similar to Philips Cat. No. TKC

24/236/Bajaj Cat. No. : BJIV-236 /Crompton Greaves Cat No. 1VE 1224 HSB

IF Incandescent GLS lamp in recessed down light having high purity aluminium reflector electrochemically brightened and anodized.

Stainless steel leaf springs and pressure die cast ceiling similar to Philips Cat.No. DN-622 Crompton greaves cat DDLV 10-BC

SFI Weather proof integral Floor Lighting with housing made of corrosion resistant die cast aluminium painted black. Grey powder coated outside suitable for 150W SON-T lamp complete with all accessories and suitable for termination with conduits/flexible

Cat. No. F69045 (C).Similar to Philips Cat. No. SWF230/150/BajajCat.No.BGEMF-150WSV Crompton Greaves Cat No. FAD 11151H

SF2 2 x 400 / 2x250W HP Sodium vapour lamps in high Flood lighting fixture suitable for outdoor mounting with aluminium enclosure : similar to Philips Cat.No. SNT001/Bajaj Cat.No. BJEF-22CA /Crompton Greaves Cat No. FHD1324

SF3 1 x 250 / 1 x 400 HP sodium vapour lamps in high Technical Specification,

flood lighting fixture suitable for outdoor mounting with aluminium enclosure and integral control gear: similar to Phillips cat. No. SWF 330/ CGL Cat. No. FAD 1114/ Bajaj Cat. No. BJEF T14CA.

PF 1x11 W CFL Lamp emergency light with Battery operated portable fixture with built in chargeable Batteries and battery charger suitable for a lighting period of six hours similar to ALPHA DELUX of M/s DELTA FLASH LITE/MICRO LITE OF M/s MICRO /BPL MAKE

FB 9W CFL lamp in Bulkhead fixtures with Cast Aluminium alloy body, suitable for column, wall, and ceiling mounting finished stove enameled silver grey outside white inside, to be supplied complete (with front cover, wire guard, tropicalized, gasket and lamp holder taped 3/4" E.T. for conduit entry) similar to Philips Cat.No.FXC 101/Bajaj Cat.No. BJBE-19/Crompton Greaves.

FF 2x36W fluorescent lamp with mirror optics in recessed mounting type decorative fluorescent fitting consisting of white stove enameled sheet steel housing with accessories and reflector of aluminium sheet steel duty electro-chemically brightened and anodised fitted with aluminium lamellae painted white. Similar to Philips Cat.No. TBS-285/236 and Bajaj Cat.No. BJLM-236/ Crompton Greaves Cat.No. CRFA 24 HSB
FL 2x36W fluorescent lamps in decorative lighting fixture with widespread mirror optics suitable for pendent mounting with twin tube complete with all accessories : similar to philips cat-No. TCS-306/236 and Bajaj Cat.No. BJSM-236/Crompton Greaves Cat No.CSB W 1124 HSB

MP 125 HP MV Lamp in weather proof post top latern with case aluminium canopy, mounting piece, opal acrylic cover tropicated gasket and all other accessories for mounting on pole top similar to philips Cat.No. HPC-101/Bajaj / Crompton Greaves

Cat No. MPT12IH/BC IB 60/100w GLS lamp in Bulkhead fixtures with Cast Aluminium alloy body, suitable for column, wall, and ceiling mounting finished stove enameled silver grey outside white inside, to be supplied complete (with front glass, wire guard, tropicalised, gasket and E.S. Porcelain, lamp holder taped 3/4" E.T. for conduit entry) similar to Philips Cat.No.NXC 101/ /Crompton Greaves IBH1110/BC

BL 2X9 Or 1x18 watt CFL bollard light for landscape lighting having FRP/LLDPE housing similar to Philips FGC202 /Crompton Greaves Cat No CFBL1129

DLR 2x18 watt CFL Down light for recess mounting lighting having similar to Philips FBH225/2X18 /Crompton Greaves Cat No DDLH218TG

DSM 1X13 WATT surface mounted CFL similar to Art Light Make Cat NO RL 3146

HL 2X 18 CFL Decorative hanging down Light Simiilar to cat no Art light RL 3166/HL

CL 1X 18 WATT Decorative ceiling mounted luminaire similar to Philips Dixie Cat FL 343/118

RECEPTACLES

RO 15A, 240V, Outdoor Receptacle 2 pole, 3- pin type R1 5/15A, 240V, Indoor Receptacle 3-pin type. RP 63A, 415V, Interlocked switch socket, outdoor receptacle

SWITCH

Modular type switches, 5/15 Amp. Receptacles.

CONDUITS AND ACCESSORIES

Galvanised Rigid Steel Conduits of 19mm/25mm/32mm/40mm dia.

JUNCTION BOXES with 5 Nos.of terminal blocks

LIGHTING POLES - (Type A1 poles & Type E1 poles)

Deleted

MAINTENANCE EQUIPMENT

- (i) A type Aluminium ladder of 3 mtr vertical height.
- (ii) Cartwheel mounted aluminium ladder Vertical Height 7.5 Mtrs. When Extended

LIGHTING TRANSFORMER

Supply, erection, testing and commissioning of 100 kVA or above (in case the capacity of transformer required is higher than 100 KVA as per approved calculations) / 25KVA (in case of substations where highest voltage level is 132kV), 415/415 V, 3 phase, 50 Hz Dry type natural air cooled lighting transformers. The technical parameters of these lighting transformers are as follows:

Technical Parameters of Lighting Transformer

Type of transformer : Dry type natural air cooled Rating : 100 KVA or above 25 KVA (as applicable) Voltage ratio : 415/415 volts No. of phases : Three Frequency : 50 Hz Winding connection : Dyn-1 Class of insulation : 'B' class Impedance : $4\% \pm 10\%$ No. of taps & steps : 5, $\pm 5\%$ in steps of 2.5% Ref. standard : IS:2026

The enclosure for the above transformer shall have degree of protection not less than IP-42. The rating of lighting transformer should be suitable for lighting load. The contractor shall submit the supporting calculation for the rating of lighting transformer.

3. LIGHTING FIXTURES AND ACCESSORIES

General

All lighting fixtures and accessories shall be designed for continuous operation under atmospheric conditions existing at site, without reduction in the life or without any deterioration of materials, internal wiring.

Temperature Rise

All lighting fixtures and accessories shall be designed to have a low temperature rise according to the relevant Indian Standards. The design ambient temperature shall be taken as 50 deg.C.

Supply Voltage

Lighting fixtures and accessories meant for 240V A.C. operation shall be suitable for operation on 240V A.C. 50Hz, supply voltage variation of $\pm 10\%$, frequency variation of $\pm 5\%$ and combined voltage and frequency variation of $\pm 10\%$. Technical

Lighting fixture and accessories meant for 220V DC operation shall be suitable for operation on 220V DC with variation between 190 to 240 Volts.

Lighting Fixtures

The lighting fixtures shall be Philips or Bajaj or Crompton Greaves make only except for fixtures type „DSM“ & „HL“ for which make has been specified elsewhere in this section. The different types of lighting fixtures are also indicated elsewhere in this Section.

All fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection.

All lighting fixtures shall be complete with fluorescent tubes / incandescent lamps/mercury vapour/sodium vapour lamps as specified and shall be suitably wired up.

All fluorescent lamp fixture shall be complete with all accessories like ballasts, power factor improvement capacitors, lamps, starters, holders etc.

3.4.4. High beam fixtures shall be suitable for pendant mounting and flood lights shall have suitable base plate / frame for mounting on steel structural member. Hook mounted high beam fixtures are not acceptable.

3.4.5 Each lighting fixture shall be provided with an earthing terminal suitable for connection to 16 SWG GI earthing conductors.

3.4.6. All light reflecting surfaces shall have optimum light reflecting co-efficient such as to ensure the overall light output as specified by the manufacturer.

3.4.7 Height of fixtures should be such that it is easy to replace the lamps with normal ladder/stool. In case the ceiling height is very high, the fixtures may be placed on the walls for ground lighting.

3.5 ACCESSORIES

Reflectors

The reflectors shall be manufactured from sheet steel or aluminium as applicable. They shall be securely fixed to the captive type.

Lamp holders and Starter Holders

(a) Lamp holders/starter holders for fluorescent tubes shall be of the spring loaded, low contact resistance, bi-pin rotor type, resistant to wear and suitable for operation at the specified temperature, without deterioration in insulation value, contact resistance or retention of the lamp/starter. They shall hold the lamp/starter in position under normal condition of shock and vibration.

(b) Lamp holders/starter for incandescent lamps and HPMV/HPSV lamps shall be of screwed type, manufactured in accordance with relevant standard and designed to give long and satisfactory service.

Ballasts

a) The Ballasts shall be designed, manufactured and supplied in accordance with relevant standard and function satisfactorily under site condition specified. The ballasts shall be designed to have a long service life and low power loss.

b) Ballasts shall be mounted using self locking anti-vibration fixing and shall be easy to remove without dismantling the fixtures. They shall be totally enclosed units.

c) The ballasts shall be of the inductive, heavy duty type, filled with thermosetting insulating moisture repellent polyester compound filled under pressure or vacuum. The ballast wiring shall be of copper wire. They shall be free from hum. Ballasts which produce humming sound shall be replaced free of cost by the Contractor. Ballasts for high pressure mercury vapour/ HPSV lamps shall be provided with suitable tapings to set the voltage within the range specified. End connections and taps shall be brought out in a suitable terminal block, rigidly fixed to the ballast enclosure.

d) Separate ballast for each lamp shall be provided in case of multi-lamp fixtures.

Starters

Starters shall have bimetal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without the use of any tool. Starters shall have brass contacts and radio interference suppressing capacitor.

Capacitors

a) The capacitors shall have a constant value of capacitance and shall be connected across the supply of individual lamp circuits.

b) The capacitors shall be suitable for operation at supply voltage as specified and shall have a value of capacitance so as to correct the power factors of its corresponding lamp circuit to the extent of 0.98 lag.

c) The capacitors shall be hermetically sealed in a metal enclosure.

Lamps

General Lighting Services (GLS) lamps shall be provided with screwed caps and shall be of 'clear' type unless otherwise specified.

The fluorescent lamps shall be 'Day-light-colour' type unless otherwise specified and shall also be provided with features to avoid blackening of lamp ends. The Bidder should clearly state these features in the bid.

Mercury vapour lamps, sodium vapour lamps shall be colour corrected type, with screwed caps.

The Bidder shall furnish typical wiring diagram for Fluorescent, HPMV & HPSV fitting including all accessories. The diagram shall include technical details of accessories i.e. starters, chokes, capacitors etc.

Flexible conduits if required, for any fixture shall be deemed to be included in Contractor's scope.

4. RECEPTACLES

a) All receptacles shall be of cast steel/aluminium, heavy duty type, suitable for fixing on wall/column and complete with individual switch.

b) In general the receptacles to be installed are of the following types :

i) Type RO-15A, 240V, 2 pole, 3 pin type with third pin grounded, metal clad with gasket having cable gland entry suitable for 2Cx6 sq.mm. PVC/aluminium armoured cable and a metallic cover tied to it with a metallic chain and suitable for installation in moist location and or outdoor. The switch shall be of rotary type. Receptacles shall be housed in an enclosure made out of 2 mm thick GI sheet with hinged doors with padlocking arrangements. Door shall be lined with good quality gasketing. This shall conform to IP- 55.

ii) Type RI The 5/15 amp 6 pin receptacles with switches will be of Modular type with flush type switches and electroplated metal enclosures of approved make

iii) Type RP - 63A, 415V, 3 phase, 4 pin interlocked plug and switch with earthing contacts. Other requirements shall be same as type RO. The receptacle shall be suitable for 3.5C x 35/3.5Cx70

sq.mm. aluminium conductor cable entry and shall also be suitable for loop-in and loop out connection of cables of identical size. Receptacle shall be suitable for outdoor application. Receptacles shall be housed in a box made out of 2mm thick G.I. sheet, with hinged door with padlocking arrangement. Door shall be lined with good quality gasketing. This shall conform to IP-55.

5. SWITCH AND SWITCH HURL

(a) All Switch HURL/boxes, 5/15 Amp Receptacles and electronic fan regulators located in office/building areas shall be modular flush mounted type or brick wall with only the switch knob projecting outside.

(b) Switch HURLs/boxes shall have conduit knock outs on all the sides. Adequate provision shall be made for ventilation of these boxes.

(c) The exact number of switches including regulator for fans and layout of the same in the switch HURL shall be to suit the requirement during installation.

(d) The maximum number of luminaires, controlled by one no 6 amp switch would 4 nos. For DC fixtures there will be no switch and the same shall be directly controlled from DC LP

(e) The luminaires shall be wired in such a fashion that luminaires on each phase are evenly distributed all over the room.

6. CONDUITS & CONDUIT ACCESSORIES

The conduits shall conform to IS:9537. All conduits shall be seamed by welding, shall be of heavy gauge and shall be hot dip galvanised.

Flexible conduits wherever required shall be made with bright, cold rolled annealed and electro-galvanised mild steel strips.

All conduits accessories shall conform to relevant IS and shall be hot dip galvanised.

7. JUNCTION BOXES

The junction boxes shall be concealed type for indoor lighting and suitable for mounting on columns, lighting poles, structures etc., for outdoor lighting.

Junction boxes shall be of square/rectangular type of 1.6 mm sheet steel with minimum 6 mm thick pressure diecast aluminium material LM-6 and shall have bolted cover with good quality gasket lining.

The junction box and cover shall be hot dip galvanised.

The junction boxes shall be complete with conduit knockouts/threaded nuts and provided with terminal strips. The junction boxes shall be suitable for termination of conduit/glands of dia 20 mm, 25 mm, 32 mm, 40 mm on all sides. The junction boxes shall be provided with 4 way terminals suitable for two numbers 10 sq. mm. wire & for street lighting/switchyard lighting suitable for 2 numbers 4C x 16 Sq.mm Al. cable.

The junction boxes shall have the following indelible markings

- (i) Circuit Nos. on the top.
- (ii) Circuit Nos. with ferrules (inside) as per drawings.
- (iii) DANGER sign in case of 415 volt junction box.

The junction boxes shall be weather proof type with gaskets conforming to IP 55 as per IS:13947 (Part I). The conduit connections shall also be properly sealed to prevent entry of water.

8. TERMINAL BLOCKS

Each terminal shall be suitable for terminating upto 2 Nos. 10 sq.mm. stranded Aluminium Conductors without any damage to the conductors or any looseness of connections. Terminal strips provided in street - lighting poles shall be suitable for terminating upto 2 nos. 4C x 16 sq. mm aluminium cables.

9. PULL OUT BOXES

9.1. The pull out boxes shall be concealed type for indoor lighting and suitable for mounting on column, structures etc., for outdoor lighting. The supply of bolts, nuts and screws required for the erection shall be included in the installation rates.

The pull out boxes shall be circular of cast iron or 16 SWG sheet steel and shall have cover with good quality gasket lining.

The pull out boxes and cover shall be hot dip galvanised.

The pull out boxes shall be completed with conduit knock outs/threaded hubs and provided at approximately 3 meters intervals in a conduit run.

10. LIGHTING PANELS (L.P.)

Each panel shall be provided with one incoming triple pole MCB with neutral link and outgoing miniature circuit breakers as per clause 2.0. The panels shall conform to IS-8623.

Constructional Features

Panels shall be sheet steel enclosed and shall be dust, weather and vermin proof. Sheet steel used shall be of thickness not less than 2.00 mm (cold rolled) or 2.5 mm (hot rolled) smoothly finished, levelled and free from flaws. Stiffeners shall be provided wherever necessary. The indoor lighting panels will be ready made DB of minimum 20 swg sheet thickness .

The panels shall be of single front construction, front hinged and front connected, suitable for either floor mounting on channels, sills or on walls/columns by suitable M.S. brackets.

Panels shall have a dead front assembly provided with hinged door(s) and out door panels will be with padlocking arrangement with single key supplied in duplicate.

All outdoor panels, removable covers, doors and plates shall be gasket all around with neoprene gaskets.

The panels shall be suitable for cable/conduit entry from the top and bottom. Suitable removable cable gland-plate shall be provided on the top and bottom of panels. Necessary number of double compression cable gland shall be supplied, fitted on to this gland plate. The glands shall be screwed on top and made of tinned brass.

The panels shall be so constructed as to permit free access to connection of terminals and easy replacement of parts.

Each panel shall have a caution notice fixed on it.

Each panel will be provided with directory holder in which printed and laminated as built circuit directory would be kept

Each Outdoor lighting panel shall be provided with one no. „ON" indicating lamp for each phase along with fuses. For indoor lighting panels din mounted phase indication lamps will be provided , mounted along side of the MCB

10.3 Main Bus Bars

10.3.1 Bus bars shall be of aluminium alloy conforming to IS:5082 and shall have adequate cross-section to carry the rated continuous and withstand short circuit currents. Maximum operating temperature of the bus bars shall not exceed 85 deg. C. The bus bars shall be able to withstand a fault level of 9 kA for 1 sec. for AC panels and 4 KA for 1 sec. for DC panels. The Indoor lighting panels shall have copper bus bar

10.4 Residual Current Circuit Breakers (RCCB)

10.4.1 For indoor panels 63A 4pole 300 ma conforming IS 12640 will be provided along with incomer

Miniature Circuit Breaker (MCB)

- a) The miniature circuit breakers shall be suitable for manual closing, opening, automatic tripping under overload and short circuit. The MCBs shall also be trip free.
- b) Single pole as well as three pole versions shall be furnished as required in the Schedule of Lighting Panels.
- c) The MCBs and panel MCCB together shall be rated for full fault level. In case the MCB rating is less than the specified fault level the bidder shall co-ordinate these breaker characteristics with the back up MCCB in such a way that if fault current is higher than breaker rating, the MCCB should blow earlier than the breaker. If the fault current is less than MCB breaking capacity, MCB shall operate first and not the incomer MCCB.
- d) The MCBs shall be suitable for housing in the lighting panels and shall be suitable for connection with stranded copper wire connection at both the incoming and outgoing side by copper lugs or for bus bar connection on the incoming side.
- e) The terminals of the MCBs and the „open“ „close“ and „trip“ conditions shall be clearly and indelibly marked.
- f) The tenderer shall check and co-ordinate the ratings of MCBs with respect to starting characteristics of discharge lamps. The vendor has to furnish overload and short circuit curve of MCB as well as starting characteristics curves of lamps for Employer's approval.
- g) The MCB shall generally conform to IS:8828.

Contactors

Contactors shall be of the full voltage, direct-on line air break, single throw, electro-magnetic type. They shall be provided with at least 2-„NC“ and 2-„NO“ auxiliary contacts. Contactor shall be provided with the three element, positive acting, ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated current. Hand reset button shall be flush with the front of the cabinet and suitable for resetting with starter compartment door closed. The Contactor shall be suitable for switching on Tungsten filament lamp also. The bidder shall check the adequacy of the Contactors rating wire with respect to lighting load.

Push Buttons

All push buttons shall be of push to actuate type having 2 „NO“ and 2 „NC“ self reset contacts. They shall be provided with integral escutcheon plates engraved with their functions. Push buttons shall be of reputed make.

Labels

- a) The lighting panels shall be provided on the front with panel designation labels on a 3 mm thick plastic

plate of approved type. The letter shall be black engraved on white back ground.

b) All incoming and outgoing circuits shall be provided with labels. Labels shall be made of non-rusting metal or 3 ply lamicold. Labels shall have white letters on black or dark blue background.

Earthing Terminals

Panels shall be provided with two separate and distinct earthing terminals suitable to receive the earthing conductors of size 50x6 G.S. Flat.

Type test reports for following tests on all lighting panels shall be submitted for approval as per clause 9.2 of section : GTR.

(i) Wiring continuity test

(ii) High voltage (2.5 KV for 1 minute) and insulation test (iii) Operational test

(iv) Degree of protection (not less than IP-55 test on outdoor Lighting Panels and IP-52 test on indoor Lighting Panels as per IS 13947 (part I)) (v) Heat run test

Lighting Transformer

Lighting transformer shall be located in MCC room, in separate enclosure. Enclosure shall have degree of protection not less than IP-42 as per IS-13947 (Part-I).

11. Emergency Portable Lighting Fixtures

The portable fixtures shall have a built in battery rated for six hours, battery chargers and solid state inverters. These shall be of approved make.

The portable fixtures shall be of a single unit, completely tropicalised and suitable for prolonged use with no maintenance.

The portable fixtures shall be supplied and necessary supporting brackets of galvanised steel suitable for wall/column mounting shall also be supplied.

The portable fixture shall come up automatically in the event of failure of normal supply.

12. LIGHTING POLES

The Contractor shall supply, store and install the following types of steel tubular lighting poles required for street lighting.

a) Type A1 Street Lighting Pole - for one fixture

b) Type E1 Post top lantern pole - for one fixture

Street/flood light poles shall conform to the enclosed drawings. In front of control room building, DG Set and Fire Fighting Buildings, decorative post top lantern (Type E1) poles and Bollards shall be installed as per the quantities given in the tender drawing.

Lighting poles shall be complete with fixing brackets and junction boxes. Junction boxes should be mounted one meter above ground level.

The lighting poles shall be coated with bituminous preservation paint on the inside as well as on the embedded outside surface. Exposed outside surface shall be coated with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium).

The galvanised sheet steel junction box for the street lighting poles shall be completely weather proof conforming to IP-55 and provided with a lockable door and HRC fuse mounted on a fuse carrier and fuse base assembly. The fuses & junction box shall be as specified in the specification. However, terminals shall be stud type and suitable for 2 nos. 16 sq. mm. cable.

Wiring from junction box at the bottom of the pole to the fixture at the top of the pole shall be done through 2.5 sq. mm wire.

Distance of centre of pole from street edge should be approximately 1000 to 1200 mm.

Earthing of the poles should be connected to the switchyard main earth mat wherever it is available and the same should be earthed through 3M long, 20 mm dia, earth electrode.

13. Deleted

14. LIGHTING WIRES

The wiring used for lighting shall be standard products of reputed manufacturers. The wires shall be of 1100 V grade, PVC insulated product of reputed manufacturers.

The conductor sizes for wires used for point wiring beyond lighting panels shall be single core 4 sq. mm., 6 sq. mm and 10 sq. mm stranded aluminium wires and 2.5 sq. mm, 4 sq. mm, 6 sq. mm and 1.5 sq. mm stranded copper wire.

The wires used for connection of a lighting fixture from a nearest junction box or for loop-in loop-out connection between two fluorescent fixtures shall be single core copper stranded conductor, 1100V grade flexible PVC insulated cords, unsheathed, conforming to IS:694 with nominal conductor cross sectional areas of 2.5 sq. mm.

The wires shall be colour coded as follows:

Red for R - Phase

Yellow for Y - Phase

Blue for B - Phase

Black for Neutral

White for DC (Positive)

Grey for DC (Negative)

15. PAINTING OF SHOP MADE ITEMS

All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS:6005 'Code of Practice for Phosphating Iron and Steel'.

Oil grease and dirt shall be thoroughly removed by emulsion cleaning.

Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying. 15.4 After phosphating through rinsing shall be carried out with clean water, followed by final rinsing with diluted dichromate solution and oven drying.

The phosphate coating shall be sealed by the application of two coats of ready mixed stoving type metal primer (comprising of red oxide and Zinc chromate in a synthetic medium). The first coat may be 'flash dried' while the second coat shall be stoved.

After application of the primer, two coats of finishing synthetic enamel paint shall be applied with each coat followed by stoving. The second finishing coat for the external of panels shall be applied after completion of tests. The panels can also be powder coated instead of painting after surface treatment as given above.

Both outside and inside of lighting panel, sheet metal fabricated junction boxes etc. and outside of lighting fixtures shall be finished in light grey (IS-5 shade 631). Inside of lighting fixtures shall be finished in white. The colour of indoor lighting panels should match with colour of wall.

Each coat of primer and finishing paint shall be of slightly different shade so as to enable inspection of the painting.

The final finished thickness of paint film on steel shall not be less than 100 microns and shall not be more than 150 microns. The final thickness of powder coating will not be less than 50 microns. For indoor lighting panels the painting will be as per approved manufacturers specification.

Finished painted appearance on equipment shall present an aesthetically pleasing appearance, free from dents and uneven surfaces.

LIGHTING SYSTEM INSTALLATION WORKS

General

In accordance with the specified installation instructions as shown on manufacturer's drawings or as directed by Employer, Contractor shall unload, erect, install, test and put into commercial use all the electrical equipment included in the contract. Equipment shall be installed in a neat, workmanship manner so that it is level, plumb square and properly aligned and oriented. Tolerances shall be as established in manufacturer's drawing or as stipulated by Purchaser.

All apparatus, connections and cabling shall be designed so as to minimise risk of fire or any damage which will be caused in the event of fire.

Conduit System

Contractor shall supply, store and install conduits required for the lighting installation as specified. All accessories/fittings required for making the installation complete, including but not limited to pull out boxes (as specified in specification ordinary and inspection tees and elbow, checknuts, male and female bushings (brass or galvanised steel), caps, square headed make plugs, nipples, gland sealing fittings, pull boxes, conduits terminal boxes, glands, gaskets and box covers, saddle terminal boxes, and all steel supporting work shall be supplied by the Contractor. The conduit fittings shall be of the same material as conduits. The contractor shall also supply 19 mm PVC conduit and accessories for telephone wiring.

All unarmoured cables shall run within the conduits from lighting panels to lighting fixtures, receptacles. etc.

Size of conduit shall be suitably selected by the Contractor.

Conduit support shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.

Conduit supports shall be clamped on the approved type spacer plates or brackets by saddles or U- bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs. Wooden plug inserted in the masonry or concrete for conduit support is not acceptable.

Where conduits are along with cable trays they shall be clamped to supporting steel at an interval of 600 mm.

For directly embedding in soil, the conduits shall be coated with an asphalt-base compound. Concrete pier or anchor shall be provided wherever necessary to support the conduit rigidly and to hold it in place.

For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring.

Conduit shall be securely fastened to junction boxes or cabinets, each with a lock nut inside and outside the box.

Conduits joints and connections shall be made through water-tight and rust proof by application of a thread compound which insulates the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

The entire metallic conduit system, shall be embedded, electrically continuous and thoroughly grounded. Where slip joints are used, suitable bonding shall be provided around the joint to ensure a continuous ground circuit.

Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.

Wiring

Wiring shall be generally carried out by PVC insulated wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawings of wires is permissible.

Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Where

required, suitable junction boxes shall be used.

Wiring shall be spliced only at junction boxes with approved type terminal strip.

For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.

For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.

Maximum two wires can be terminated to each way of terminal connections. Separate neutral wires are to be provided for each circuit.

AC and DC wiring should not run through the same conduit.

Lighting Panels

The lighting panels shall be erected at the locations to be finalised during detailed engineering.

Suitable foundations/supporting structures for all outdoor type lighting panels shall be provided by the Contractor.

Foundation & civil works

Foundation for street lighting poles, panel foundation and transformer foundation shall be done by the Contractor.

All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the Contractor including minor modification of civil works as may be required for erection.

15. PANTHER CONDUCTOR

GENERAL TECHNICAL SPECIFICATION AND OTHER TERMS AND CONDITIONS FOR SUPPLY OF ACSR PANTHER CONDUCTOR

2.3.1 SCOPE:

This section of the specification covers the technical specification for design manufacture, testing and supply of ACSR PANTHER (Aluminium conductor galvanized steel reinforced) conductor for use in high voltage transmission lines.

2.3.2 DELETED.

2.3.3 STANDARD:

The design manufacture, galvanizing and testing of ACSR conductor against this tender shall conform to the following Indian standard specification as amended up to-date:-

- i) IS:390 (Part-II)- Specification for ACSR conductor for overhead Transmission purposes.
- ii) IS:2633-1966- recommended practice for hot dip galvanizing of iron & steel.
- iii) IS:2633-1972- Method for testing uniformity of coating on zinc coated articles.
- iv) IS:4826-1979-Specification for hot dipped galvanizer coatings on round steel wires.
- v) IS:6745-1972- Method for determination of Mass of Zinc Articles.
- vi) IS:209-Specification of Zinc.
- vii) IS:1778- Specification for Reels & Drums for Bare conductors.

2.3.4 TECHNICAL PARTICULARS:

The important technical requirements of ACSR conductor are enclosed in specific technical particulars.

2.3.5 QUANTITY:

The size and quantity of ACSR conductor proposed for procurement against this tender shall be furnished by the tenderer

2.3.6 MATERIAL AND WORKMANSHIP:

2.3.6.1 The material and workmanship will strictly conform to the requirement of IS:398

Part-II as amended up to date.

2.3.6.2 The individual wires as well as the stranded conductor shall be smooth as free from all imperfections as spills & splits. The steel wires shall be evenly and uniformly coated with zinc complying with IS:209.

2.3.7 RAW MATERIALS:

2.3.7.1 Procurement of all raw materials for manufacture and testing of ACSR conductor shall be arranged by the suppliers at their own cost. HURL will not be responsible for arranging raw materials. As such the rates quoted for supply of conductor shall include the cost of all raw materials. Any extension in delivery period shall not be allowed on pretext of non-availability or interest, will have to ensure to have adequate stock of all raw materials for complete supply.

2.3.7.2 The tenderers shall state in their tender the name of the maker's from where they propose to procure the raw materials. The supplier shall not procure any raw materials for the purpose of their tenders unless otherwise approved by the purchaser in written.

2.3.8 TEST DURING MANUFACTURE:

2.3.8.1 The individual wires as well as the finished ACSR conductor during manufacture shall be tested in accordance with the stipulation made in IS:398 part-II as amended up to date.

2.3.8.2 Six copies of test reports for all Routine tests as carried out during manufacture of the conductor shall be furnished to the purchaser for approval immediately after the material is ready after manufacture and is offered for inspection.

2.3.8.3 The test reports shall clearly state the designated number of drums and length of conductor covered the test reports. The reports shall also clearly indicate the test reports. The reports shall also clearly indicate the specified values as per IS: 398 (part-II) of each parameter to facilitate checking of the test reports.

2.3.8.4 The purchaser may ask the suppliers to carry out even such tests which may not have been specifically laid down in the Indian which may not have been specifically laid down in the Indian standard specification but being done as normal practice and which in opinion of purchaser is necessary for ascertaining quality of material. All costs of tests carried out on above shall be born by the suppliers.

2.3.9 TYPE TESTS:

2.3.9.1 The tenderers are advised that they should submit copies of latest type test reports conducted either by CPRI, Bangalore or TAG Corporation, Madras for the conductor being procured under this tender. However, if considered necessary, the purchaser may also get the ACSR conductor tested for type test at C.P.R.I, Bangalore or at TAG Corporation, Madras before accepting the materials. In that event the supplier will have offer Random Sample of conductor immediately after placement of purchase order which shall be collected and sealed jointly by the representative of the purchaser and the supplier and shall be sent for carrying out type tests.

2.3.9.2 Following tests shall constitute type tests.

- i) Surface condition test of ACSR conductor.
- ii) Ultimate tensile strength test of ACSR conductor.
- iii) D.C Resistance test.
- iv) Corona /Radio interference voltage test, if applicable.

2.3.9.3 Once the sample is drawn in the entire responsibilities of getting the type test conducted and submission of report of the same will be of the supplier. However, if the supplier has submitted along with their offer reports against type tests carried out by CPRI, Bangalore or Tag Corporation, Madras and the report is considered satisfactory and acceptable by the purchaser, further carrying out of type test may be waived.

2.3.10 PRE DESPATCH INSPECTION:

2.3.10.1 The purchaser representative shall at all reasonable time have free access in the works and at all places of manufacture where conductor under order will be manufactured and the manufacturer/supplier shall at his cost provide the purchaser or himself that the material to be supplied is in accordance with the specification.

The entire material will be inspected by purchaser's authorized representative as per relevant I.S.S before dispatch for which the supplier shall intimate the purchaser in writing the date and place where the materials are ready for inspection & testing. On receipt of such intimation, the purchaser will depute his representative for carrying out inspection. A period of four /six weeks shall be allowed to purchaser for deputing and making travel arrangement of his representative.

In case of any part of the material is intended to be manufactured at any premises other than the supplier, this will be done only with due approval of purchaser in writing and in that case the suppliers shall have to make arrangement for the purchaser's representative to inspect & test the materials as if the material were being manufactured at their own premises.

The inspection call shall be given when the material have actually been manufactured in all respect and not on the basis of anticipated dated of completion. In case the materials are not found ready for inspection at the time of arrival of purchaser inspector, supplier shall have to pay to HURL a sum of Rs.1,000/-per day from the date of departure to the date of arrival of the inspecting officer to his headquarter besides the rail/air ticket fair.

After material are inspected, a joint inspection report will be prepared with purchasers Inspector and supplier's representative and four copies of such inspection reports will be submitted to the purchaser. Purchaser, however, at his discretion may consider to waive inspection in writing in some cases in which case supplier will have to conduct all necessary tests themselves and got those test reports approved by the purchased from it's point of manufacture unless it has been satisfactorily inspected, tested approval and dispatch clearance issued by the purchaser.

Acceptance of any quantity of material on the basis of above inspection and approval will however, not absolve the supplier in any manner of their primary responsibility towards the quality of materials to be supplied as per requirement of specification.

2.3.11 PACKING & MARKING:

The conductor shall be supplied in non-returnable strong drums with logging of non-perishable & treated wood conforming to IS: 1778 as amended up to date. Such drum or reel, shall be marked with the following:-

- i) Trade name, if any,
- ii) Name of manufacturer.
- iii) Contract/specification number.
- iv) Name and address of the consignee.
- v) Size & type of conductor.
- vi) Total length of conductor in KM
- vii) No. of conductor length on each drum.
- viii) Net weight of the conductor.
- ix) Gross weight of the conductor.
- x) Weight of empty drum with protective lagging.
- xi) Position of the conductor end and arrow marking for unwinding.

The drum shall also be marked with ISI certification marks.

The reels shall be of such construction as to ensure delivery of conductor in the field free from displacement and damage and shall be capable to withstand all stresses due to handling & stringing operations. The conductor surface shall not get dented, scratched or damaged in any way during handling, transportation erection. The supplier shall be responsible for all damage due to improper and inadequate packings. The conductor shall be properly lagged on the drums and method of legging to be employed shall be clearly stated in the tender. It shall not be notched to suit the reel but held in place by steel strapping.

The conductor drum shall be suitable for wheel mounting. The barrel of the drum on which conductor will be wound, shall be lined with water proof and abrasion resistant paper to avoid corrosion & abrasion of ACSR conductor. The inside flange of the drum should be painted with aluminium paint.

After winding the conductor on the reel, the exposed surfaces shall be wrapped suitable to prevent the conductor from dirt & grit and also to prevent the conductor from damages in the event of breakages of the buttons.

SPECIFIC TECHNICAL PARTICULARS OF 'PANTHER' CONDUCTOR

1. CONDUCTOR DATA

(a)	Complete Conductor	
(i)	Code Name	"Panther "
(ii)	Size/ Stranding	50/3.00 mm Alum + 7/3.00 mm steel.
(iii)	ISS to which conductor shall conform to	IS. 398- Part_II
(iv)	Nominal copper area	130. sq.mm
(v)	Diameter of complete conductor	21.00 mm
(vi)	Nominal Aluminum Area	200.00 Sq. mm
(vii)	Sectional Area of Aluminium	212.10 Sq. mm
(viii)	Total sectional area	261.50 sq. mm
(ix)	Approximate total weight	974 Kg/KM
(x)	Ultimate tensile strength of conductor.	9127 KG
(xi)	Approx. calculated breaking load.	89.67 KN
(xii)	Calculated resistance at 20 degree(maxm).	0.1400 ohm/KM
(xiii)	Final module of Elasticity	80GN/meter
(xiv)	Co-efficient of liner expansion	17.7x10 ⁻⁶ Per. °C
(xv)	Standard length in which conductor Will be supplied. requirement of the site)	1.2 Kms ±5%(As per actual
(xvi)	Lay Ratio	
(a)	Steel Core	Max-28 Min - 13
(b)	Aluminium	
	12 wires	Max-16 Min -10
	13 Wires	Max-14 Min- 10

(B) Strands

		Aluminium	
WIRES		Steel	Aluminium
(i)	No. of strand Diameter(mm)	30	7
(ii)	Standard		
(a)		3.00	3.00
(b)	Maximum	3.03	3.06
C	Minimum	2.97	2.94
(iii)	Sectional area(mm ²)	7.069	7.069
(iv)	Weight (Kg/Km)	19.11	55
(V)	Resistance at 20 °C when Corrected to standard wt.		
(a)	Standard (ohm/Km)	4.025	--
(b)	Maximum (ohm/Km)	4.107	--
vi)	Minimum ultimate tensile Sts (Kg/mm ²)	16.80	134
Vii	Maximum Breaking Load		
	Before stranding (KN)	1.11	9.29
	After standing (KN)	1,11	8.83

ZINC COATING:

- a) No. of one minute dip -- 3
- b) Minimum weight of zinc -- 26 g/m²
- a) Process of galvanising joint in strands -- as per IS: 398

2. REEL OR DRUM:

- a) No. of standard length One
- b) Dimension of reel of drum As per requirement
- c) Specification for drum IS:1778

3. MATERIAL AND WORKMANSHIP

- a) The aluminium wires shall be hard drawn form electrolytic aluminium rod having purity not less than 99.5% the end of the conductor shall be treated in approved manner to avoid ingress of moisture.
- b) The steel wires shall be drawn form high carbon steel wire rods produced either by the acid or the basic open hearth process or by the electric process. Steel produced by Bessemer process shall not be used for drawing wire and shall conform to the following requirements as regards to the chemical composition.

Element	Composition percentage
Carbon	0.50 to 0.85
Manganese	0.50. to 1.10
Phosphorus	Not more than 01.035
Sulphur	Not more than 0.045
Silicon	0.10 to 0.35

The steel wire shall be hot dip galvanized conforming to IS:2629-1966 (latest) and shall have weight of zinc coating as per IS:4126-1968 (latest). The quality of zinc for coating, of steel wire strands shall be Zn 98 of IS: 209 electrolytic high grade zinc of 99.95% purity.

LONG ROD POLYMER INSULATOR

TECHNICAL SPECIFICATIONS **OF LONG ROD POLYMER INSULATORS**

CONTENTS

Clause No.	Description
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3.0	Bid Drawings
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TECHNICAL SPECIFICATIONS

SECTION-II

1.0 Technical Description of Composite Long Rod Insulators

1.1 Details of Composite Long Rod Insulators

- 1.1.1** The insulators of the strings shall consist of composite long rod insulators for a three phase, 50 Hz, effectively earthed for 220KV/132KV transmission system applications in a very heavily polluted environment. Couplings shall be ball and socket type suitable for fitting in the existing lines designed for disc insulators or Long rod polymer insulators or both. The proposed long rod polymer insulator shall be suitable for fitting in the transmission line towers originally designed/erected with consideration of Disc insulators.
- 1.1.2** Bidder shall quote such composite insulators which have proven use under foggy/ humid operational conditions in polluted industrial environment combined with smoke and dust particles. The Bidder shall furnish evidence in the form of certification from the power utilities that the similar type of product supplied to them had been performing satisfactory. The Bidder shall also submit certified test report for an accelerated ageing test of 5000 hours such as that described in Appendix-C of IEC-61109.
- 1.1.3** Insulators shall have sheds of the “open aerodynamic profile without any under ribs” with good self-cleaning properties. Insulator shed profile, spacing projection etc. shall be strictly in accordance with the recommendation of IEC-60815.
- 1.1.4** The size of long rod insulator, minimum creepage distance, the number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string alongwith hardware fittings shall be as follows:

S. No.	Type of String	*Size of Composite Insulator (Core dia x Nominal length) (mm)	Minimum Creepage Distance (mm)	No. of individual Units per String (Nos.)	Electro-Mechanical Strength of Insulator Unit (kN)	Mechanical Strength of Insulator String along with Hardware Fittings (kN)
For 220 kV AC Transmission lines with single Zebra conductor						
1	Single Suspension	20x2030	7595	1x1	90	90
2	Single Tension	20x2175	7595	1x1	120	120
For 132 kV AC Transmission lines with single Panther conductor						
1	Single Suspension	20x1305	4495	1x1	70	70
2	Single Tension	20x1450	4495	1x1	90	90

Note: *The core dia of composite insulators mentioned at column No.3 is for indicative purpose. The bidder shall offer composite long rod insulators of suitable core dia to meet specified E&M and torsion strength requirements. For offered core dia, less than indicated in table above, the bidder shall submit documentary evidence of past supplies & satisfactory operation of the same for minimum period of three years. However, the overall string length shall be within the limits specified in the drawing.

1.2 Pin and Cap

1.2.1 Pin and cap shall be designed to transmit the mechanical stress and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric of such design that it will not yield or distort under load conditions.

1.2.2 The design shall be such as to permit easy removal of replacement of either insulator units or fittings under the live line conditions.

1.3 Ball and Socket Designation

The dimensions of the Ball and Socket shall be of 16 mm designation for 70 kN & 90 kN Insulator in accordance with the standard insulators and 20 mm designation for 120 kN dimensions stated in IEC:60120/ IS:2486 (Part-II).

1.4 Dimensional Tolerance of Composite Insulators

The tolerances on all dimensions e.g. diameter, length shall be allowed as follows:

$$\pm (0.04d+1.5) \text{ mm when } d \leq 300 \text{ mm.}$$

$$\pm (0.025d+6) \text{ mm when } d > 300 \text{ mm.}$$

Where, d being the dimensions in millimeters for diameter, length as the case may be.

The tolerance in creepage distance shall be based on design dimensions and their tolerances. However, no negative tolerance shall be applicable to creepage distance specified in clause 1.1.4.

1.5 Interchangeability

The composite long rod insulators inclusive of the ball & socket connection shall be standard design suitable for use with the hardware fittings of any make conforming to relevant IEC standards.

1.6 Corona and RI Performance

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and shall not generate any radio interference beyond specified limit under the operating conditions.

1.7 Maintenance

1.7.1 The long rod insulators offered shall be suitable for employment of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

1.7.2 All insulators shall be designed to facilitate cleaning and insulators shall have the minimum practical number of sheds and grooves. All grooves shall be so proportioned that any dust deposit can be removed without difficulty either by wiping with a cloth or by remote washing under live line condition.

1.8 Materials

1.8.1 Core

It shall be a glass-fiber reinforced (FRP rod) epoxy resin rod of high strength. The rod shall be resistant to hydrolysis. Glass fibers and resin shall be optimized. The rod shall be electrical grade corrosion resistant (ECR), boron free glass and shall exhibit both high electrical integrity and high resistance to acid corrosion.

1.8.2 Housing & Weather sheds

The FRP rod shall be covered by a sheath of a silicone rubber compound of a thickness of minimum 3mm. The housing & weather sheds should have silicon content of minimum 30% by weight. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core. The interface between the housing and the core must be uniform and without voids. The strength of the bond shall be greater than the tearing strength of the polymer. The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core. The technique to be followed with detailed procedure and sampling shall be furnished by the Supplier and finalized during finalization of MQP.

The weather sheds of the insulators shall be of alternate shed profile. The weather sheds shall be vulcanized to the sheath (extrusion process) or molded as part of the sheath (injection molding process) and free from imperfections. The vulcanization for extrusion process shall be at high temperature and for injection molding shall be at high temperature & high pressure. Any seams / burrs protruding axially along the insulator, resulting from the injection molding process shall be removed completely without causing any damage to the housing. The track resistance of housing and shed material shall be class 1A4.5 according to IEC60587. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The composite insulator shall be capable of high pressure washing.

1.8.3 End Fittings

End fittings transmit the mechanical load to the core. They shall be made of malleable cast iron spheroidal graphite or forged steel. They shall be connected to the rod by means of a controlled compression technique. The manufacturer shall have in-process Acoustic emission arrangement or some other arrangement to ensure that there is no damage to the core during crimping. This verification shall be in-process and done on each insulator. The system of attachment of end fitting to the rod shall provide superior sealing performance between housing and metal connection. The gap between fitting and sheath shall be sealed by a flexible silicone rubber compound. The sealing shall stick to both housing and metal end fitting. The sealing must be humidity proof and durable with time.

End fittings shall have suitable provisions for fixing grading rings at the correct position as per design requirements.

1.8.4 Grading Rings

Grading rings shall be used at both ends of each composite insulator unit for reducing the voltage gradient on and within the insulator and to reduce radio and TV noise to acceptable levels. The size and placement of the metallic grading rings shall be designed to eliminate dry band arcing/corona cutting/ exceeding of permissible electrical stress of material. The insulator supplier shall furnish design calculations using appropriate electric field software showing electric field at surface of housing, inside housing & core and at the interface of housing and metal fittings with the proposed placement and design of corona. Grading rings shall be capable of installation and removal with hot line tools without disassembling any other part of the insulator assembly.

The design & supply of grading rings shall be in the scope of the composite insulator supplier.

1.9 Workmanship

- 1.9.1** All the materials shall be of latest design and conform to the best modern practices adopted in the extra high voltage field. Bidders shall offer only such insulators as are guaranteed by him to be satisfactory and suitable for transmission lines specified and will give continued good service.
- 1.9.2** The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners to limit corona and radio interference.
- 1.9.3** The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 1.9.4** The core shall be sound and free of cracks, impurities and voids that may adversely affect the insulators.
- 1.9.5** Weathersheds/ Housing shall be uniform in quality. It shall be free from voids and impurities. Weathersheds/ Housing shall be clean, sound, smooth and free from gross defects and excessive flashing at parting lines.
- 1.9.6** End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress, effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with the projecting points or irregularities which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 1.9.7** All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 600 gm/sq.m. and shall be in accordance with the requirement of ISO:1461 (E) and shall satisfy the tests mentioned in ISO:1460 (E). The zinc used for galvanizing shall be of purity of 99.95%. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters.

The galvanized metal parts shall be guaranteed to withstand at least six successive dips each

lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

1.9.8 BLANK.

2.0 Equipment Marking

2.1 Each composite long rod unit shall be legibly and indelibly marked with the trade mark of the manufacturer, name of HURL and month & year of manufacture. The guaranteed combined mechanical and electrical strength shall be indicated in kilo Newton followed by the word 'kN' to facilitate easy identification and to ensure proper use.

2.2 One 10 mm thick ring or 20 mm thick spot of suitable quality of paint shall be marked on the cap/end fitting of each composite long rod of particular strength for easy identification of the type of insulator. The paint shall not have any deteriorating effect on the insulator performance. Following codes shall be used as identification mark:

For	70 kN long rod unit	: Black
For	90 kN long rod unit	: Orange
For	120 kN long rod unit	: Yellow

3.0 Bid Drawings

3.1 The Bidder shall furnish full description and illustration of the material offered.

3.2 The Bidder shall furnish along with the bid the outline drawing of each insulator unit along with grading rings including a cross sectional view of the long rod insulator unit. The drawing shall include but not limited to the following information:

- (a) Major Dimensions with manufacturing tolerances
- (b) Minimum creepage distance with positive tolerance
- (c) Protected creepage distance
- (d) Unit mechanical and electrical characteristics
- (e) Size and weight of ball and socket parts
- (f) Weight of composite long rod units
- (g) Materials
 - (i) Identification mark
 - (ii) Manufacturer's catalogue number
- (h) Eccentricity of the long rod unit
 - (i) Axial run out
 - (ii) Radial run out

3.3 After placement of award, the Supplier shall submit full dimensioned insulator drawings

containing all the details as given in Clause No. 3.2 above, in six (6) copies to Owner for approval.

- 3.4** After placement of award the Supplier shall also submit fully dimensioned insulator cratedrawing for different type of insulators.

4.0 Tests and Standards

4.1 Type Tests

The required type tests on 70kN, 90 kN and 120 kN insulators for 132kV/ 220 kV transmission line for unit and complete strings are stipulated hereunder. The bidder should have successfully completed all specified type tests for 70kN, 90 kN and 120 kN insulators on individual units and complete strings for 132kV/ 220 kV transmission line and shall submit copies of type test reports along with the bid. Bidders, not meeting the requirement, shall not be considered qualified/ technically non-responsive.

The following type tests shall be conducted on composite long rod insulator units, components, materials or complete strings:

4.1.1 On the complete composite Long Rod Insulator String with Hardware Fittings

			Strings on which test to be conducted.
(a)	Power frequency voltage withstand test with corona control rings/grading ring and arcing horns under wet condition	IEC:383-1993/ Annex-A	All Strings
(b)	Switching surge voltage withstand test under wet condition	IEC:383-1993	All Strings
(c)	Impulse voltage withstand test under dry condition	IEC:383-1993	All Strings
(d)	Corona and RIV test under dry condition	Annex-A	All Strings
(e)	Mechanical Strength test	Annex-A	All Strings
(f)	Vibration test	Annex-A	All Strings except pilot
(g)	Salt-fog pollution withstand test	Annex-A	All Strings except pilot

4.1.2 On Composite Insulator Units

(a)	Tests on interfaces and connections of metal fittings	IEC: 61109-2008
(b)	Assembled core load time test	IEC: 61109-2008
(c)	Damage limit proof test and test of tightness of interface between end fittings and insulator housing.	IEC: 61109-2008
(d)	High Pressure washing test	Annexure-A
(e)	Brittle fracture resistance test	Annexure-A
(f)	Dye penetration test	IEC: 61109-2008
(g)	Water diffusion test	IEC: 61109-2008
(h)	Tracking and erosion test	IEC: 61109-2008
(i)	Hardness test	IEC: 61109-2008
(j)	Accelerated weathering test	IEC: 61109-2008
(k)	Flammability test	IEC: 61109-2008
(l)	Silicone content test	Annexure-A
(m)	Recovery of Hydrophobicity test	Annexure-A
(n)	Torsion test	Annexure-A

4.1.3 Hardness test, Accelerated weathering test & Flammability test specified under Clause No.4.1.2 above shall be conducted on housing/ weathershed of 70kN, 90 kN & 120 kN composite long rod Insulator for the same type of material.

4.1.4 All the type test given in Clause No. 4.1.1 shall be conducted on Single suspension, Single Tension insulator string along with hardware fittings.

4.2 Acceptance Tests:

4.2.1 For Composite Long Rod Insulators

(a)	Verification of dimensions	IEC: 61109-2008
(b)	Galvanising test	IEC : 60383
(c)	Verification of end fittings	IEC: 61109 -2008
(d)	Recovery of Hydrophobicity	Annexure-A
(e)	Verification of tightness of interface between end fittings and insulator housing and of specified mechanical load	IEC : 61109-2008
(f)	Tests on interfaces and connections of metal fittings	IEC: 61109-2008
(g)	Silicone content test	Annexure-A
(h)	Brittle Fracture Resistance Test	Annexure-A
(i)	Dye Penetration Test	IEC :61109-2008
(j)	Water Diffusion Test	IEC : 61109-2008

The test 4.2.1.(f) to (j) shall be carried out as acceptance test on any one lot.

In the event of failure of the sample to satisfy the acceptance test(s) specified in 4.2above, the latest procedure shall be as per IEC 61109.

4.3 Routine Tests

4.3.1 For Composite Long Rod Insulator Units

- (a) Visual Examination - As per IEC:61109-2008
- (b) Mechanical routine test - As per IEC:61109-2008

4.4 Tests During Manufacture

On all components as applicable

(a)	Chemical analysis of zinc used for galvanising	As per Annexure-A
(b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.	As per Annexure-A
(c)	Chemical analysis hardness tests and magnetic particle inspection for forgings	As per Annexure-A
(d)	Tracking and erosion test on insulating material	IEC 60587

4.5 Testing Expenses

4.5.1 As mentioned under clause 4.1 above, no type test charges shall be payable to the supplier.

4.5.2 Type tests specified under Clause 4.1.1 (a) to (h) and 4.1.2 above shall not be required to be carried out if a valid test certificate is available for a similar design. The tests certificate shall be considered valid if:

- i) Tests conducted earlier is either conducted in accredited laboratory (accredited based on ISO/IEC vide 25/17025 or EN 45001 by the National accreditation body of the country where laboratory is located) or witnessed by the representative(s) of HURL and
- ii) Tests mentioned above have been conducted within 5 (five) years prior to the date of bid opening.

In case the test have been conducted earlier than the above stipulated period or in the event of any discrepancy in the test report (i.e., any test not applicable due to any design/manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specifications), the tests shall be conducted by the Supplier at no extra cost to the Purchaser.

4.5.3 For Type Tests which involves the tests on the complete insulator string with hardware fitting, standard hardware fittings similar to existing insulator strings shall be arranged and used by the insulator supplier at his own cost.

4.5.4 In case of failure in any type test the supplier is either required to modify the design of the material & successfully carryout all the type tests as has been detailed out in Clause 4.1 of this specifications or to repeat that particular type test at least three times successfully at his own expenses.

4.5.5 Bidder shall indicate the laboratories in which they propose to conduct the type tests. They shall

ensure that adequate facilities are available in the laboratory and the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule.

4.5.6 The entire cost of testing for acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted Ex-works/ CIF Price.

4.5.7 In case of failure in any type test, if repeat type tests are required to be conducted, then all the expenses for deputation of Inspector/ Owner's representative shall be deducted from the contract price. Also if on receipt of the Supplier's notice of testing, the Owner's representative does not find the material or test setup / equipments to be ready for testing, the expenses incurred by the Owner for redeputation shall be deducted from contract price.

4.5.8 The Supplier shall intimate the Owner about carrying out of the type tests along with detailed testing programme at least 3 weeks in advance (in case of testing in India) and at least 6 weeks advance (in case of testing abroad) of the scheduled date of testing during which the Owner will arrange to depute his representative to be present at the time of carrying out the tests.

4.6 Sample Batch for Type Testing

4.6.1 The Supplier shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner. The Supplier shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner.

4.6.2 Before sample selection for type testing, the Supplier shall be required to conduct all the acceptance tests successfully in presence of Owner's representative.

4.7 Schedule of Testing

4.7.1 The Bidder has to indicate the schedule of following activities in their bids:

- a) Submission of drawing for approval.
- b) Submission of Quality Assurance Programme for approval.
- c) Offering of material for sample selection for type tests.
- d) Type testing.

4.8 Additional Tests

4.8.1 The Owner reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.

4.8.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test centre. In case of evidence of non compliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner.

4.9 Guarantee

The Supplier of insulators shall guarantee overall satisfactory performance of the insulators.

4.10 Test Reports

- 4.10.1** Copies of type test reports shall be furnished in at least three (3) copies along with one original. One copy shall be returned duly certified by the Owner only after which the commercial production of the concerned material shall start.
- 4.10.2** Copies of acceptance test reports shall be furnished in at least three (3) copies. One copy shall be returned duly certified by the Owner, only after which the material shall be dispatched.
- 4.10.3** Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Owner's representative.
- 4.10.4** Test certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

4.11 Inspection

- 4.11.1** The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
- 4.11.2** The material for final inspection shall be offered by the Supplier only under packed condition as detailed in clause No.4.12 of the specification. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot should be homogeneous and should contain insulators manufactured in 3-4 consecutive weeks.
- 4.11.3** The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 4.11.4** No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Owner in writing. In the latter case also the material shall be dispatched only after satisfactory testing for all tests specified herein have been completed.
- 4.11.5** The acceptance of any quantity of material shall be no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such material are later found to be defective.

4.12 Packing and Marking

- 4.12.1** All insulators shall be packed in suitable PVC/ plastic tubes/ any other suitable packing. The packing shall provide protection against rodent. The Supplier shall furnish detailed design of the packing. For marine transportation, crates shall be palletted.
- 4.12.2** The packing shall be of sufficient strength to withstand rough handling during transit, storage at

site and subsequent handling in the field.

4.12.3 Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling. All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each case/crate shall have all the markings stenciled on it in

4.12.4 The Supplier shall guarantee the adequacy of the packing and shall be responsible for any loss or damage during transportation, handling, storage and installation due to improper packing.

4.13 Standards

The insulator strings and its components shall conform to the following Indian/ International Standards which shall mean latest revision, with amendments/ changes adopted and published, unless specifically stated otherwise in the Specification.

4.13.1 In the event of supply of insulators conforming to standards other than specified, the Bidders shall confirm in his bid that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

Sl. No.	Indian Standard	Title	International Standard
1.	IS:209-1992	Specification for zinc	BS:5456
2.	IS:406-1991	Method of Chemical Analysis of Slab Zinc	BS:5456
3.	IS:731-1991	Porcelain insulators for overhead Power lines with a nominal voltage greater than 1000 V	BS:137-(I&II) IEC:60383
4.	IS:2071 Part (I) – 1993 Part(II)- 1991 Part(III)- 1991	Methods of High Voltage Testing	IEC:60060-1
5.	IS:2486 Part- I-1993 Part- II-1989 Part-III-1991	Specification for Insulator fittings for Overhead Power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	BS:3288 IEC:60120 IEC:60372
6.	IS:2629-1990	Recommended Practice for Hot, Dip Galvanisation for iron and steel	ISO-1461 (E)
7.	IS:2633-1992	Testing of Uniformity of Coating of zinc coated articles	
8.	IS:6745-1990	Determination of Weight of Zinc Coating on Zinc coated iron and steel articles	BS:433-1969 ISO:1460-1973
9.	IS:8263-1990	Methods of RI Test of HV insulators	No.07/

			1964/ CISPR
10.	IS:8269-1990	Methods for Switching Impulse test on HV insulators	IEC:60506
11.		Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
12.		Salt Fog Pollution Voltage Withstand Test	IEC:60507
13.		Composite insulators for A.C. Overhead lines with nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria	IEC:61109
14.		Selection and dimensioning of high voltage insulators intended for use in polluted conditions: Polymer Insulators for AC systems	IEC:60815-3
15.		Tests on insulators of Ceramic material or glass or glass for overhead lines with a nominal voltage greater than 1000V	IEC:60383
16.		Composite string insulator units for overhead lines with a nominal voltage above 1000V : Standard strength classes and end fittings	IEC 61466-1
17.		Composite string insulator units for overhead lines with a nominal voltage above 1000V : Dimensional and electrical characteristics	IEC: 61466-2
18		Electrical Insulating materials used under severe ambient conditions –Test methods for evaluating resistance to tracking and erosion	IEC: 60587
19		Polymeric insulators for indoor and outdoor use with nominal voltage greater than 1000V- General definitions, tests, methods and acceptance criteria.	IEC: 62217

The standards mentioned above are available from:

Reference Abbreviation	Name and Address
BS	British Standards, British Standards Institution 101, Pentonville Road, N - 19-ND, UK
IEC/CISPR	International Electro technical Commission, Bureau Central de la Commission, electro Technique internationale, Rue de verembe, Geneva, SWITZERLAND

BIS/IS	Beureau Of Indian Standards. Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi - 110001. INDIA
ISO	International Organisation for Standardization. Danish Board of Standardization Danish Standardizing Sraat, Aurehoegvej-12 DK-2900, Heeleprup, DENMARK
NEMA	National Electric Manufacture Association, 155, East 44th Street. New York, NY 10017 U.S.A.
ASTM	American Society for Testing and Materials, 1916 Race St. Philadelphia, PA19103 USA

ANNEXURE-A

1.0 Tests on Complete Strings with Hardware Fittings

1.1 Corona Extinction Voltage Test (Dry)

The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than 154 kV (rms) line to ground under dry condition for 220 kV line. There shall be no evidence of corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC: 60383.

1.2 RIV Test (Dry)

Under the conditions as specified under (1.1) above, the insulator string along with complete hardware fittings shall have a radio interference voltage level below 1000 micro volts at one MHz when subjected to 50 Hz AC voltage of 154 kV line to ground under dry condition for 220kV line. The test procedure shall be in accordance with IS: 8263/ IEC: 60437.

1.3 Mechanical Strength Test

The complete insulator string along with its hardware fitting excluding arcing horn, corona control ring, grading ring and suspension assembly/dead end assembly shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to, remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

1.4 Vibration Test

The suspension string shall be tested in suspension mode, and tension string in tension mode itself in laboratory span of minimum 30 meters. In the case of suspension string, a load equal to 600 kg shall be applied along the axis of the suspension string by means of turn buckle. The insulator string along with hardware fittings and the sub-conductors tensioned at 25% of conductor UTS shall be secured with clamps. The system shall be suitable to maintain constant tension on each sub-conductors throughout the duration of the test. Vibration dampers shall not be used on the test span. All the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulators string (more than 10 Hz) by means of vibration inducing equipment. The peak to peak displacement in mm of vibration at the antinode point, nearest to the string, shall be measured and the same shall not be less than $1000/f^{1.8}$ where f is the frequency of vibration in cycles/sec. The insulator string shall be vibrated for not less than 10 million cycles without any failure.

After the test, the insulators shall be examined for looseness of pins and cap or any crack. The

hardware shall be examined for looseness, fatigue failure and mechanical strength test. There shall be no deterioration of properties of hardware components and insulators after the vibration test. The insulators shall be subjected to the Mechanical performance test followed by mechanical strength test as per relevant standards.

1.5 Salt-fog pollution withstand test

This test shall be carried out in accordance with IEC : 60507. The salinity level for composite long rod insulators shall be 160 Kg/m³ NaCl.

2.0 Composite Longrod Insulator Units

2.1 Brittle Fracture Resistance Test

The test arrangement shall be according to Damage limit proof test with simultaneous application of 1N-HNO₃ acid directly in contact with naked FRP rod. The contact length of acid shall not be less than 40mm and thickness around the core not less than 10mm. The rod shall withstand 80% of SML for 96 hours.

2.2 Recovery of Hydrophobicity Test

- (1) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.
- (2) Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester, Holding the electrode approximately 3mm from the sample surface, slowly move the electrode over an area approximately 1" x 1". Continue treating this area for 2 – 3 minutes, operating the tester at maximum output.
- (3) Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic, with an HC value of 6 or 7. If not, dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.
- (4) Allow the sample to recover and repeat the hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

2.3 Silicone content test

Minimum content of silicone as guaranteed by supplier shall be verified through FT-IR spectroscopy & TGA analysis or any other suitable method mutually agreed between Owner & Supplier in Quality Assurance Programme.

2.4 High Pressure washing test

The washing of a complete insulator of each E&M rating is to be carried out at 3800 kPa with nozzles of 6 mm diameter at a distance of 3m from nozzles to the insulator, The washing shall be carried out for 10minutes. There shall be no damage to the sheath or metal fitting to housing interface. The verification shall be 1 minute wet power frequency withstand test at 460kV r.m.s for 220KV and 275 kV for 132 kV.

2.5 Torsion Test

Three complete insulators of each E&M rating shall be subjected to a torsional load of 55Nm. The torsional strength test shall be made with test specimen adequately secured to the testing machine. The torsional load shall be applied to the test specimen through a torque member so constructed that the test specimen is not subjected to any cantilever stress. The insulator after torsion test must pass the Dye Penetration Test as per IEC 61109.

3. Tests on All components (As applicable)

3.1 Chemical Analysis of Zinc used for Galvanizing

Samples taken from the zinc ingot shall be chemically analysed as per IS:209-1979. The purity of zinc shall not be less than 99.95%.

3.2 Tests for Forgings

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality Assurance Programme.

3.3 Tests on Castings

The chemical analysis, mechanical and metallographic tests and magnetic, particle inspection for castings will be as per the internationally recognized procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality Assurance Programme.

1.0 Tests on Complete Strings with Hardware Fittings

1.1 D.C Voltage Withstand test without Corona control Rings (Wet)

The procedure for this test be the same as specified in BS:137 (Part-I) Clause 3.4 and 3.5 except that the insulator string shall be tested without the Corona Control rings.

1.2 DC Corona Extinction Voltage Test (Dry)

The sample assembly consisting of complete insulator string when subjected to D.C voltage shall have a corona extinction voltage of not less than 550 kV (positive) as applicable under dry condition, or no corona should occur under a voltage gradient of 22 kV/cm on conductor. There shall be no evidence of corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC : 60383.

1.3 DC RIV Test (Dry)

Under the conditions as specified under (1.2) above, the insulator string along with complete hardware fittings shall have a radio interference voltage level below 1000 micro volts at one MHz when subjected to conductor surface gradient of 22 kV/cm (positive) under dry condition. The test procedure shall be in accordance with IS:8263 / IEC : 60437.

1.4 D.C Pollution Withstand Voltage test

This test shall be carried out generally as per IEC-61245 with solid layer method. The test insulator after cleaning should be completely dried. The insulator shall be then preconditioned using a dry sponge or soft brush to slightly paste an even layer of dry Kaolin on the surface of specimen. Excessive Kaolin should be removed using dryer to get a very thin layer on the insulator. The insulator should be then polluted within one hour of this pre-conditioning using mixture of salt, Kaolin and de-ionized water using immersion/ daubing/ spraying techniques. The test insulator shall then be left for transfer of hydrophobicity (time to be guaranteed by the insulator supplier but limited to four days). This shall be followed by the voltage withstand test under fog. The D.C. pollution withstand voltage (negative) shall be 500 kV at average ESDD of 0.6 mg / sq. cm. The test is to be performed on Single suspension „V“ String and Quad tension string preferably in the same configuration. However, in case of laboratory limitations to carry out the test in tension mode for Quad tension strings, the test may be carried out in vertical mode at the same ESDD level. For Single suspension „V“ string, test may be performed on one arm of the suspension „V“ string substituting the other arm with dummy insulators of suitable DC withstand level.

**GUARANTEED TECHNICAL PARTICULARS OF COMPOSITE LONG
ROD POLYMER INSULATORS FOR 132kV/ 220kV TRANSMISSION LINE**

Sr. No.	Description	Unit	70 KN	90 KN	120 KN
1.	Name & address of manufacture				
2.	Weight of single unit	Kg			
3.	Size and designation of ball & socket assembly	mm			
4.	Core diameter	mm			
5.	Tolerance on core diameter	±mm			
6.	Nominal length (section length)	mm			
7.	Tolerance on Nominal length	±mm			
8.	Dry arcing distance	mm			
9.	Number of sheds	Nos.			
10.	Sheds profile (type)				
11.	Shed spacing	mm			
12.	Sheds profile (regular alternating)				
13.	Shed diameter	mm			
14.	Tolerance on shed diameter	±mm			
15.	Minimum creepage distance	mm			
16.	Tolerance on Creepage distance	mm			
17.	Guaranteed mechanical strength	kN			
18.	Routine mechanical load	KN			
19.	Material a) FRP rod b) Weather sheds with % contents of silicon c) Housing d) End fittings Grading rings				
20.	Minimum thickness of sheath covering over the core	mm			
21.	Power frequency withstand voltage of single unit a) Dry Wet	KV (rms) KV (rms)			
22.	Power frequency flashover voltage of single unit a) Dry Wet	KV (rms) KV (rms)			

23.	Impulse withstand voltage of single unit (dry) a) Positive Negative	KV (peak) KV (peak)			
24.	Impulse flashover voltage of single unit (dry) a) Positive Negative	KV (peak) KV (peak)			
25.	Purity of zinc used for galvanizing end fittings	%			
26.	Number of dips which the end fittings can withstand in standard preece test	Nos.			
27.	Certified test report of accelerated ageing test of 5000 hours (enclosed) (appendix-C of IEC-61109)	Yes/No.			
28.	Drawing enclosed	Yes/No.			
29.	Confirm whether the offered long rod insulator shall be suitable for fitting & fixing in the existing transmission lines with disc insulators. Also confirm that no modification in the hardware accessories/ tower structures will be required for replacing the existing disc insulators by the long rod polymer insulators.	Yes/No.			
30.	Confirm that the long rod polymer insulators shall be supplied with suitable packing for safe keeping in the store for a longer period without any damage.	Yes/No.			

HARDWARE FITTINGS

GENERAL TECHNICAL SPECIFICATION AND TERMS & CONDITIONS OF SUPPLY FOR HARDWARE

FITTINGS FOR MOOSE CONDUCTOR

1 SCOPE :

This section of the specification covers the technical specification and other terms & condition design, manufacture, testing and supply of conductor/Earthwire accessories and hardware fittings as per details in specification.

2 STANDARD :

Design, Manufacture, Galvanised and Testing of conductor/Earthwire Accessories and hardware fittings shall conform to the following Indian Standard Specification as amended up to date.

- i) IS:2121 – Specification for fittings for Aluminium and Steel cored Aluminium conductors.
- ii) IS:2486 – Specification for insulator fittings for over head powerlines.
- iii) IS:209 – Specification for Zinc.
- iv) IS:2629 - Recommended practice for hot dip galvanized for Iron &Steel.
- v) IS:2633 – Method for testing uniformity of zinc coating on hot dip zinc coated articles.
- vi) IS:9708 – Specification for Vibration dampers.
- vii) IS:2141 – (Part-II) Mid span compression joint.
- viii) IS:2141 – (Part-II) Specification for vibration damper.

4. TECHNICAL PARTICULARS :

(A) GENERAL REQUIREMENTS

Material offered shall be of best quality and workmanship. All casting shall be free from blow-holes, flaws, cracks or other defects and shall be smooth, close grained and of true forms and dimensions. All machined surfaces shall be true, smooth and well finished.

Metal fittings or drop forged steel or heat treated malleable cast iron for insulator string hardware shall have excellent mechanical and electrical properties, such as strength, toughness and high corrosion resistance and free from corona formation. The material employed in the manufacture of accessories, viz aluminium, aluminium alloys, malleable iron, forged steel and stainless steel depending on the types of application, shall be corrosion resistant and machinable.

Fittings and accessories shall be supplied complete in all respects, suitable for the proposed attachment and for the size of conductor and Earthwire for which they are to be used.

All bolts, nuts, screw heads shall be of the whitworth standard thread. Bolt heads and nuts shall be hexagonal. If required the nuts and tapped holes shall be cut out after galvanizing and shall be well lubricated/greased. All other threads shall be cut out before galvanizing. The bolt threads shall be under cut to take care increase in diameter due to galvanizing. Washers shall be electro galvanized.

Bolts, nuts, washers split pins, security clip etc. shall be supplied as per actual requirement plus 2.5% extra.

The general design of hardware shall be such as to ensure uniformity, high strength, free from corona formation.

All hooks, eyes, pins, bolts, suspension clamps and other fittings for attaching insulators to the towers or to the line conductors shall be so designed as to reduce to minimum the damage to conductors, insulators or the fittings arising from the conductor vibrations.

Adequate bearing area between fittings shall be provided and point or line contact shall not be there.

All fittings shall be resistant to atmospheric corrosion and shall be suitably protected against corrosion both in storage and service.

The accessories shall be such as to avoid local corona formation or discharge likely to cause interference to either sound or vision transmission. Visible corona voltage of conductor accessories shall be greater than 11% or maximum line to neutral voltage of the line.

B) CONDUCTOR FITTINGS:

I) Compression type Mid span Joints.

Compression type mid span straight joints offered shall conform to technical particulars.

II) REPAIR SLEEVES :

Compression type repair sleeves shall be made of extruded aluminium and shall be suitable to provide reinforcement for conductor with broken or damaged aluminium strands. The repair sleeves shall be designed to make good conductor of which not more than 1/6 of the strands in the outer most layer are damaged/severed. The repair sleeves after compression should present smooth surface. The repair sleeves shall be so designed that conductivity of the joint shall not be less than 100% of that of conductor. Other details will be as per drawings and of technical particulars.

III) PREFORMED ARMOUR RODS:

Helically twisted formed armour rods offered shall be suitable for ACSR Moose/Panther conductors to provide rigidity and protection to the conductor at all the suspension points due to vibrations.

Armour rods shall be made of 99.6% pure electrolytic Aluminium or Aluminium alloy depending

on the type of construction. The armour rods shall be marked in the centre suitable to indicate the commencement point of applying armour rods. No joint shall be permitted in the rods except those made in base rods before drawing. The armour rods shall be capable of being fixed by hand on the conductor without the aid of any tools or implements. The direction of spiral shall be the same as that of the conductor. The wires of the outer most layer of aluminium strands of the conductor shall have right hand lay. The loading stress of armour rods on the conductor shall be evenly distributed over the entire length and there shall be no tendency of loosening at the ends. Preformed armour rods shall not lose their resilience even after two or three applications. The rods should be capable of providing high self retaining strength and protection against vibration damage and fatigue failure of conductor. The ends should be properly ball ended. So that the danger of corona formation is avoided.

The surface of the armour rods when fitted on the conductor, shall be smooth and free from protection cuts and abrasions etc. Dimensional sketch of the armour rod is enclosed with this specification.

IV) STOCK BRIDGE VIBRATION DAMPERS.

A dimensional sketch of the stock bridge 4R type vibration damper is attached with this specification. Calculation and complete details of design, weight etc. of the damper shall be furnished with the tender together with the damping characteristics and energy dissipation curves of the dampers and guaranteed of their effectiveness for the specified conductor. For the purpose of these calculations, the design data shall be given in this specification. The offer is liable to be rejected in absence of the above details.

The vibration damper shall be of approved design. The clamp of the vibration damper shall be made of aluminium alloy, so designed as to prevent any damage to or chaffing of the conductor during erection or continued operation. If there is any chance of the clamp chaffing, the conductor while in service suitable aluminium liners, shall be provided. The messenger cable shall be made of high tensile strength steel strands and preformed in order to prevent subsequent drop of weights in service. The damper weight made of cast iron shall be attached to messenger cable by approved methods, clamping bolt shall be provided with self locking nuts.

All ferrous parts including the messenger cable, shall be hot dip galvanized. The ends of the messenger cable shall be effectively sealed to prevent corrosion. The vibration damper and its attachments shall have smooth surface, to avoid corona formation. The clamp of the stock bridge vibration damper shall be so designed that in case of loosening of the bolt or changing free part of the clamp it does not allow damper to disengage from the conductor.

C) INSULATOR HARDWARE FITTINGS :

The insulator hardware fittings for suspension and tension towers shall generally constitute of following components :-

- i) Anchor shackle for ball hook for attachment of the suspension strings to tower

hanger and tension strings to tower strain plates.

- ii) Suitable yoke assembly for double suspension and double tension fittings.
- iii) Suitable arching horns and fittings.
- iv) Suspension/tension clamps.
- v) Sag adjustment plates for dead end assembly.
- vi) Other fittings i.e. eye links, chain link, ball clevises, socket clevis, eye clavicle, clevises etc.
- vii) Bolts and nuts, washers split pins etc.

CLAMPS

1.SUSPENSION CLAMPS

Suspension clamps offered shall be made of high strength aluminium alloy suitable for use with conductor with armour rod. The design shall be such as to avoid hot spot, Kicks cuts, Grooves projectors etc. Which are likely to damage conductor or lead to localized pressure, Clamps shall have satisfactory corona performance, no sharp radius or curvatures, ridge and excrescence etc, cotter pins, cotter bolts, U. Bolts, nuts, washers, etc. shall be made of galvanized steel. Split pins of suitable size and strength shall be made of brass. The clamps shall permit the conductor to slip before failure of the conductor and shall have sufficient slipping strength to resist conductor tension under broken wire conditions. It shall have sufficient contact surface to minimize damage due to fault current.

2.TENSION CLAMPS :

Tension clamps shall be made of aluminium alloy and shall be of proper type. The clamps shall not permit, slip of any damage to or failure of the conductor at a load of less than 95% of the ultimate strength of conductor. Mechanical efficiency of the clamp shall not be affected by method of erection involved. Come along or similar clamp during stringing operations.

3.ARCHING HORN :

The Insulator hardware assembly shall have provision for fixing a set of arcing horns on the Insulator hardware fittings.

4.VIBRATION DAMPERS :

Vibration damper shall be of stock bridge type having an aluminium alloy clamp compressed on the steel messenger strand between counter weights made of cast iron and shall be suitable for use on the overhead ground wire.

5.RAW MATERIALS :

Procurement of all raw materials for execution of this contract shall be done by the supplier at their own cost.

6.DRAWINGS :

The tenderer shall submit fully dimensioned drawings to scale indicating the materials of each part for dimension all under supply. The complete string drawing, both suspension and tension, shall indicate the over all length with its variations when subjected to tension as also the sparkover distance. The following arrangement of complete insulator strings and their component parts shall be clearly indicated.

- i) Attachment to the tower hanger or strain plate.
- ii) Arcing Horn attachments.
- iii) Suitable ball and socket type fittings for interconnecting insulator units to the top and bottom clamps.
- iv) Detailed drawings of suspension and tension clamps indicating design adopted for preventing damage to the conductor & earthwire.

The material offered shall be in conformity with the purchaser's drawings attached with this specification. Any deviation from those drawings conforming to any other standard quoted by the tenderer will be subject to technical scrutiny by the Purchaser who shall have every right to accept or reject the same without assigning any reason thereof.

7. GALVANISING :

All ferrous metal parts except those made of stainless steel shall be galvanized in accordance with latest issue of IS:2629 or any other equivalent authoritative standard. The weight of zinc coating shall conform to latest issue of IS:2633. The zinc used for galvanization shall conform to grade Zn-98 as per latest issue of IS:209. Spring washers, where used, shall be electro galvanized.

8.INTER CHANGEABILITY :

All hardware fitting and conductor accessories shall be of standard design and made to gauge of jig and shall be interchangeable in all respects with similar items.

9.TESTS/REPORTS :

Conductor accessories and hardware fittings will be subjected to all tests as per relevant Indian Standard Specification. The tests will be categorized in three grades, normally

- (i) Type.
- (ii) Acceptance Tests and
- (iii) Routine Tests.

TYPE TESTS :

Type Tests are normally carried out once and is not required to be carried out against all orders. Tenderers are, therefore to submit along with their offer reports in respect of Type Tests carried out as per provision of Indian Standard Specification by a reputed/recognized testing laboratory.

ACCEPTANCE TESTS :

These are such tests which are carried out for acceptance of material. This will constitute all tests as prescribed in the relevant Indian Standard Specification.

ROUTINE TESTS :

These are such tests which will apply to all fittings.

Reports in respect of all tests carried out during manufacture as per Indian Standard specification will be submitted to department for approval at the time material is offered for inspection.

Tenderers shall clearly state in their tender about testing facilities available in the laboratories at their works to confirm their ability to carry out all tests as per Indian Standard Specification.

Costs in carrying out any/all tests as above will be borne by the tenderer and will be included in their quoted price.

G.I. EARTH WIRE

SPECIFIC TECHNICAL REQUIREMENT OF G.S.S 7/9 EARTH WIRE DETAILS OF PARTICULARS :

STRANDED EARTH WIRE :

1	Size of Earth wire	7/9 SWG Earth wire (110 Kg/mm ² quality).
1	ISS to which earth wire conform	IS: 2141-1968 (Up-to-date)
2	Overall diameter of earth wire (mm)	10.98
3	Total weight (Kg/Km)	583
4	Cross sectional area (mm ²)	73.64
5	Minimum ultimate tensile strength (Kgf/mm ²)	110
6	Minimum breaking load (kg)	8134
7	Co-efficient of linear expansion per °C (Calculated).	11.5x10 ⁻⁶
8	Calculated modulus of Elasticity (kg/Cm ²)	1.933x10 ⁶
9	D.C resistance at 20°C (Ohm/Km)	3.00
10	Length of lay of stranded earth wire (mm).	
	a) Maximum	172
	b) Minimum	153
11	Standard length in which earth wire will be supplied.	2.3/2.4 KM / As per requirement

INDIVISUAL STRAND/WIRE

1	Number of wire	7
2	Diameter of each wire (mm)	3.66
3	Tolerance on diameter (mm)	±0.025
4	Standard sectional area (mm ²)	10.51

5	Minimum elongation in 100 mm length (mm)	5
6	Normal length without any joint or weld meter.	1500
7	Ultimate tensile strength (Kg/mm ²)	110
8	Minimum Breaking load (Kg)	1163
9	Zinc Coating.	
	a) No of one minute dip	3
	b) Minimum weight of coating (gm/m ²)	275
	c) Quality of zinc Zn-99.99 as per	IS:209
10	Oiling Galvanised earthwire shall be dipped in boiled linsud oil	

REEL/DRUM :

a) No. of standard length on one drum.	ONE
b) Weight and dimension of drum.	As per requirement.
c) ISS to which drum shall conform.	IS: 1778

TECHNICAL SPECIFICATION FOR COMPOSITE FIBRE-OPTIC OVERHEAD GROUNDWIRE (OPGW), FO APPROACH CABLE AND JUNCTION BOX WITH HARDWARE ACCESSORIES

1.0 OPTICAL GROUNDWIRE (OPGW)

The OPGW cable construction shall comply with IEEE-P 1138 and IEC publications 1396. The cable provided shall meet both the construction and performance requirements such that the ground wire function, the optical fibre integrity and optical transmission characteristics are suitable for the intended purpose. The cable shall consist of optical fibre units as defined in earlier. There shall be no factory splices within the cable structure of a continuous cable length.

The OPGW structure shall be based on the following characteristics:

The composite fibre optic overhead ground wire shall be made up of buffered optical fibre units embedded in a water tight aluminium / aluminium alloy / stainless steel protective central fibre optic unit surrounded by concentric-lay stranded metallic wires in single or multiple layers. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre.

Electrical characteristics of the OPGW must be equal to or better when compared to standard ground wire. The electrical conductivity must be designed to withstand the specified short circuit currents. The OPGW cable selected shall withstand the temperature increase caused by the maximum short circuit current. The Bidder shall describe the electrical parameters of the OPGW proposed.

The mechanical structure of OPGW shall be designed to withstand the wind and other environmental conditions in the routes, which have been specified in this document. The location of the fibres inside the structure shall be such that the application of the OPGW in the specified routes is possible. The selected OPGW cable shall tolerate the normal installation procedures. The Bidder shall list the mechanical parameters of the OPGW and describe the cable structure including how the fibres are located inside, and shall furnish the cross-sectional drawing of OPGW.

The cable structure shall be such that the fibres are protected against water, hydrogen ultraviolet radiation and other environmental hazards encountered in India.

The metallic wires have to give the OPGW, conductivity to carry fault currents and the strength to withstand mechanical stresses. Aluminium alloy, aluminium clad steel wires or a combination of them shall be used. The OPGW shall withstand, without change in its characteristics a lightning current of 150 kA (peak). The

minimum allowable radius of bending for OPGW within the specified temperature range should be $20 \times D$, where D is the outer diameter of the OPGW.

The fibre tubes shall have a high crush resistance and minimum permanent or temporary deformation under mechanical pressure. The fittings must be designed to prevent these pressures. OPGW elongation under different stress situations likely during wind loads or during ground faults shall be considered.

1.1 Basic Construction

Fibre Optic Cable Construction Overhead Fibre Optic Cables shall be 24 core OPGW (Optical Ground Wire). The OPGW cable is proposed to be installed on the transmission line 400kV IBTPS -Meramandali of Orissa Power Transmission Corporation Ltd. (OPTCL). The design of cable shall account for the varying operating and environmental conditions that the cable shall experience while in service. The exact transmission line details shall be collected by the Contractor during survey.

The cable construction shall conform to the applicable requirements of applicable clauses of IEC 1809 related to stranded conductors and Table 2.2(a) OPGW Mechanical and Electrical Characteristics. In addition, the basic construction shall include bare concentric-lay-stranded metallic wires with the outer layer having left hand lay. The wires may be of multiple layers with a combination of various metallic wires within each layer. The direction of lay for each successive layer shall be reversed. The finished wires shall contain no joints or splices; however, in case the contractor feels that joints or splices are absolutely necessary, it should only be done upon obtaining approval from the Employer and conforming all applicable clauses of IEC 1089 as they pertain to stranded conductors.

The wires shall be so stranded that when the complete OPGW is cut, the individual wires can be readily regrouped and then held in place by one hand.

1.2 Central Fibre Optic Unit

The central fibre optic unit shall be designed to house and protect multiple buffered optical fibre units from damage due to forces such as crushing, bending, twisting, tensile stress and moisture. The central fibre optic unit and the outer stranded metallic conductors shall serve together as an integral unit to protect the optical fibres from degradation due to vibration and galloping wind and ice loadings, wide temperature variations, lightning and fault current, as well as environmental effects which may produce hydrogen. The central fibre optic unit may include an aluminium tube/hermetically sealed stainless steel tube. If aluminium rod is used, it shall be fabricated with one or more channels or grooves and formed into a helix to house the buffered optical fibres. An outer protective shield shall be applied around the rod such as an aluminium tube or helically-applied overlapping aluminium tape to provide an additional mechanical and environmental barrier.

1.3 Breaking Strength

The rated breaking strength of the complete OPGW shall be taken as no more than 90% of the sum of rated breaking strengths of the individual wires, calculated from their nominal diameter and the specified minimum tensile strength.

The rated breaking strength shall not include the strength of the optical unit. The fibre optic unit shall be considered a load bearing tension member when determining the total rated breaking strength of the composite conductor.

1.4 Electrical and Mechanical Requirements

Table 1-1(a) provides OPGW Electrical and Mechanical Requirements for the minimum performance characteristics. Additionally, the OPGW mechanical & electrical characteristics shall be similar to the electrical & mechanical characteristics of the earthwire specified such that there is no or minimal consequential increase in stresses on towers. The standard GSS earthwire parameters are listed hereunder. For the purpose of determining the appropriate Max. working Tension limit for the OPGW cable, IS 802:1995 and IS 875:1987 shall be applied. However the OPGW installationsag & tension charts shall be based on IS 802 version to which the line is originally designed. For the OPGW cable design selection and preparation of sag tension charts the limits specified in **civil specification** shall also be satisfied. The Bidder shall submit sag-tension charts with their bids.

Table 1.1(a)
OPGW Electrical and Mechanical Requirements

Number of optical fibers in OPGW	24/48
Fiber Description:	Dual-Window Single-Mode
Mode Field Diameter:	8.6 to 9.5 μm ($\pm 0.6\mu\text{m}$)
Cladding Diameter:	125.0 $\mu\text{m} \pm 1 \mu\text{m}$
Mode field concentricity error	$\leq 0.6\mu\text{m}$
Cladding non-circularity	$\leq 1\%$
Cable Cut-off Wavelength λ_{cc}	$\leq 1260 \text{ nm}$
1550 nm loss performance	As per ITU-T G.652 D
Proof Test Level	$\geq 0.69 \text{ Gpa}$
Attenuation Coefficient:	@ 1310 nm $\leq 0.35 \text{ dB/km}$ @ 1550 nm $\leq 0.21 \text{ dB/km}$
Chromatic Dispersion; Maximum:	18 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339nm 5.3 ps/(nm x km) 1271-1360nm
Zero Dispersion Wavelength:	1300 to 1324nm
Zero Dispersion Slope:	0.092 ps/(nm ² xkm) maximum
Polarization mode dispersion coefficient	$\leq 0.2 \text{ ps/km}^{1/2}$
Temperature Dependence:	Induced attenuation $\leq 0.05 \text{ dB}$ (-60°C - +85°C)
Bend Performance:	@ 1310 nm (75 \pm 2 mm dia Mandrel), 100 turns; Attenuation Rise $\leq 0.05 \text{ dB/km}$ @ 1550 nm (75 \pm 2 mm Dia Mandrel), 100 turns; Attenuation Rise $\leq 0.05 \text{ dB/km}$ @ 1550 nm (32 \pm 0.5 mm dia Mandrel, 1 turn; Attenuation Rise $\leq 0.50 \text{ dB/km}$

Table 1.2(b)**Existing Galvanised Stranded Steel Wires (7/3.15mm&7/3.66mm) used as Earthwire.**

Sl. No.	Description	Technical Particulars	
		132KV &220KV	400KV
1.	Grade of Steel wire	1100N/sq. Mm.	
2.	Total weight	428 Kg/Km (standard)	583 Kg/Km (standard)
3.	Maximum working tension at 32°C with full wind	2962 Kg	3705.2 Kg
4.	Maximum working tension at 32°C with No wind	1425.8 Kg	1326.4 Kg
5.	Standard of compliance	IS-2141/BS - 183	
6.	Minimum breaking load	56 KN	68.34 KN
7.	Overall diameter	11.7 mm	10.98 mm
8.	Modulus of elasticity	787000 Kg/sq. cm.	1860000 Kg/sq.cm.
9.	Co-efficient of linear expansion	17.8×10^{-6} per deg C	11.5×10^{-6} perdeg C

1.5 Operating Conditions

Since OPGW shall be located at the top of the EHV transmission line support structure, it will be subjected to Aeolian vibration, galloping and lightning strikes. It will also carry ground fault current. Therefore, its electrical and mechanical properties shall be the same or similar as those required of conventional G.I. ground conductors (7/3.15 mm&7/3.66mm).

1.6 Installation

OPGW shall be installed on the top of 400KV, 132KV & 220KV Transmission Towers. The installation shall be generally in accordance with the IEEE Guide to the installation of Overhead Transmission Line Conductors (IEEE STD, 524 with latest revisions), with additional instructions and precautions for live line working and fibreoptic cable handling.

1.7 Marking, Packaging and Shipping

This section describes the requirements for marking, packaging and shipping the fibre optic cable.

- a] **Drum Markings :** Each side of every reel of cable shall be permanently marked in a minimum of 5cm high white lettering with the vendor's address, the Employer's destination address, cable part number and specification as to the type of cable, length, number of fibres, a unique drum number including the name of the transmission line and segment no, factory inspection stamp and date.

- b] Cable Drums :** All optical fibre cabling shall be supplied on strong drums provided with lagging of strong drums provided with lagging of adequate strength, constructed to protect the cabling against all damage and displacement during transit, storage and subsequent handling during installation. Both ends of the cable shall be sealed as to prevent the escape of filling compounds and dust & moisture ingress during shipment and handling. Spare cable caps shall be provided with each drum as required.

The spare cable shall be supplied on sturdy, corrosion resistant, steel drums suitable for long periods of storage and re-transport & handling.

There shall be no factory splices allowed within a continuous length of cable. Only one continuous cable length shall be provided on each drum. The lengths of cable to be supplied on each drum shall be determined by a "schedule" prepared by the Contractor; however, the length of cable generally be 4km.

1.8 Installation Hardware

The scope of supply of the optical cable includes the assessment, supply and installation of all required fittings and hardware. The Bidder shall provide documentation justifying the adequacy and suitability of the hardware used. To ensure their satisfactory performance, the Contractor shall determine the exact requirements of all accessories used to install and secure the OPGW.

The OPGW hardware fittings and accessories shall follow the general requirements regarding design, materials, dimensions & tolerances, protection against corrosion and markings as specified in § 4.0 of EN 61284 1997 (IEC 61284). The shear strength of all bolts shall be at least 1.5 times the maximum installation torque. The OPGW hardware & accessories drawing & GTP shall consist of all component reference numbers, dimensions and tolerances, bolt tightening torques & shear strength and ratings such as UTS, slip strength etc. shall be marked on the drawings.

The fittings and accessories described herein are indicative of installation hardware typically used of OPGW installations and will be used for payment purposes and any extra fittings if required are to be supplied & erected without any extra cost. The bidder should carry out an actual field survey and to assess such extra attachments so that their cost can be included in the supply rates of the specified items while quoting.

1.8.1 Suspension Assemblies :

Performed armour grip suspension clamps and aluminium alloy armour rods/reinforcing rods shall be used. The suspension clamps shall be designed to carry a vertical load of not less than 25KN. The suspension clamps slippage shall occur between 12KN and 17KN as measured in accordance with type test procedures.

The Contractor shall supply all the components of the suspension assembly including shackles, bolts, nuts, washers, split pins, etc. the total drop of the suspension assembly shall not exceed 150mm (measured from the centre point of attachment to the centre point of the OPGW). The design of the assembly shall be such that the direction of run of the OPGW shall be the same as that of the conductor. The designed length of the assembly should be such as not to violate the electrical clearance between OPGW & Live conductor.

1.8.2 Dead End Clamp Assemblies :

All dead end clamp assemblies shall be of the performed armoured grip type and shall include all necessary hardware for attaching the assembly to the tower strain plates. Dead end clamps shall allow the OPGW to pass through continuously without cable cutting. The slip strength shall be rated not less than 95% of the rated tensile strength of the OPGW.

1.8.3 Clamp Assembly Earthing Wire :

Earthing wire consisting of a 1500 mm length of aluminium or aluminium alloy conductor equivalent in size to the OPGW shall be used to earth suspension and dead end clamp assemblies to the tower structure. The earthing wire shall be permanently fitted with lugs at each end. The lugs shall be attached to the clamp assembly at one end and the tower structure at the other.

1.8.4 Structure Attachment Clamp Assemblies (for attachment with (a) Suspension Towers & (b) Tension Towers) :

Clamp assemblies used to attach the OPGW to the structures shall have two parallel grooves for the OPGW, one on either side of the connecting bolt. The clamps shall be such the clamping characteristics do not alter adversely when only one OPGW is installed. The tower attachment plates shall locate the OPGW on the inside of the tower and shall be attached directly to the tower legs/cross-members without drilling or any other structural modifications. Clamp assemblies earth wire should be provided for attachment to each suspension/tension tower.

1.8.5 Vibration Dampers :

Vibration dampers type 4R Stockbridge or equivalent, having four (4) different frequencies spread within the Aeolian frequency bandwidth, shall be used for suspension and tension points in each span. The Contractor shall determine the exact numbers and placement(s) of vibration dampers through a detailed vibration analysis, if required. Vibration damper clamps shall be made of aluminium or aluminium alloy, shall support the dampers during installation and shall maintain the dampers in position without damage to the OPGW and without causing fatigue. Armour or patch rods made of aluminium or aluminium alloy shall be provided as required to reduce clamping stress on the OPGW. The vibration damper body shall be hot-dip galvanized mild steel/cast iron or shall be permanent mould cast zinc alloy. Damper placement charts along with calculations need be submitted by the successful bidder.

2.0 Fibre Optic Approach Cables

For purposes of this specification, a fibre optic approach/lead cable is defined as the cable installed between the final in line splice enclosure on the gantry forming the termination of the fibre cable on the power line (OPGW) and the Fibre Optic Distribution Panel (FODP) installed within the terminal building. The Contractor shall supply and install the optical fibre approach cable as required based on detailed site survey to be carried out by the Contractor during the project execution.

Approach Cable shall be a UV resistant fire retardant rodent proof, armoured cable with steel tape, corrugated tube or galvanized wire type armour construction cable. The cable shall be suitable for direct burial, laying in trenches & PVC/Hume ducts, laying under false flooring and on indoor or outdoor cable raceways and shall have minimum 2.0 mm HDPE outer jacket thickness.

Approach cable shall contain fibres with identical optical/physical characteristics as those in the aerial cables. The cable core shall comprise of tensile strength member(s), fibre support/bedding structure, core wrap/bedding, and an overall impervious jacket.

It will be the responsibility of the Contractor to arrange for splicing of the Approach Cable with the OPGW cable inside a splice box located at the base of the terminal towers at both ends.

The termination of the other end of the approach cable inside the building will be done by the Contractor.

3.0 Fiber Optic Splice Enclosures (Joint Box)

All splices shall be encased in Fiber Optic Splice Enclosures. Suitable splice enclosures shall be provided to encase the optical cable splices in protective, moisture and dust free environment. Splice enclosures shall comply to ingress protection class IP 66 or better. The splice enclosures shall be designed for the storage and protection of required number of optical fiber splices and equipped with sufficient number of splice trays for splicing all fibers in the cable.

No more than 6 fibers shall be terminated in a single splice tray. They shall be filled with suitable encapsulate that is easily removable should re-entry be required into the enclosures. Splice enclosures shall be suitable for outdoor use with each of the cable types provided under this contract. Splice enclosures shall be appropriate for mounting on transmission line towers above anti-climb guard levels at about 10 meters from top of the tower and shall accommodate pass-through splicing. The actual mounting height and location shall be finalized after Survey. Contractor shall be responsible for splicing of fibers and installation of splice enclosures

4.0 Optical Fibre Termination and Splicing

Optical fibre terminations shall be installed in Fibre Optic Distribution Panels (FODP) designed to provide protection for fibre splicing of preconnectorized pigtails and to accommodate connectorized termination and coupling of the fibre cables. The Contractor shall provide appropriate sized Fiber Optic Distribution Panels (FODPs) and shall terminate the fibre optic cabling upto the FODPs. The Contractor shall be responsible for connectivity between the FODP and the terminal equipment. The location of FODP rack shall be fixed in suitable place preferably adjacent to the Optical equipment.

5.0 Fibre Optic Distribution Panels

At each location requiring the termination of at least one fibre within a cable, all fibres within a cable, all fibres within that cable shall be connectorized and terminated in Fibre Optic Distribution Panels in a manner consistent with the following :

- a) All fibre optic terminations shall be housed using FODPs provisioned with splice organizers and splice trays. All fibres within a cable shall be fusion spliced to preconnectorized pigtails and fitted to the “Back-side” of the provided fibre optic couplings.
- b) FODPs shall be suitable for use with each of the cable types provided as part of this contract. FODPs shall accommodate pass-through splicing and fibre terminations.
- c) All FODPs shall be of corrosion resistant, robust construction and shall allow both top of bottom entry for access to the splice trays. Specific selection of the entry points shall be made at the time of installation. Ground lugs shall be provided on all FODPs and the Contractor shall ensure that all FODPs are properly grounded. The FODP for indoor installation shall meet or exceed ingress protection class IP55 specifications.

d) **FODP will be of minimum 96 fibre.**

Table 1.2(c)
Technical details of FODP

Sl. No.	Description	Technical Particulars
1	Dimension (H*W*D) mm	1400*600*400
2	Construction Materials	Sheet Steel/ CRCA minimum 2mm thick
3	Installation clearance: Front Access (cm) Rear Access(cm): Top*Bottom*Sides(cm)	60 60 60
4	Colour & Finish	Light Grey, RAL 7035
5	Coating thickness	75 µm
FODP 96Fibres Sub-rack		
1	Construction Materials	Cold-Rolled Steel minimum 2mm thick
2	Cable Glanding & Fixing	Six Cable glanding & fixing
3	Locking Arrangement	Two slots for door snap-on/ Two slots with Nylatch
4	Total no. Of optical couplings	96 FC/PC connectors
5	Provision for pass through splicing	yes
6	No. of cables that can be accommodated	6 (each of 48Fibre)
7	Diameter of cable that can be accommodated	8-30mm
8	Cable entry	Suitable for all 24 & 48 Fibre approach cable
9	Method of mounting	19" rack mounting in cabinet
Splice Trays		
1	Material	Acrylonitrile Butadiene Styrene(ABS)
2	Method of mounting	Sub-rack containing all splice trays or individual splice trays to be of sliding and detachable type.
3	No. of splice Trays	8
4	Maximum no. of splices per tray	12

6.0 Optical Fibre Connectors

Optical fibres shall be connectorised with **FC-PC type** connectors. Fibre optic coupling supplied with FODPs shall appropriate for the fibre connectors to be supported. **There shall be no adapters allowed.**

7.0 IN-LINE FIBRE OPTIC SPLICE ENCLOSURES

All in-line splices shall be enchased in In-Line Fibre Optic Splice enclosures. Suitable splice enclosures shall be provided to encase the optical cable splices in a protective enclosure and dust free environment. The splice enclosures shall be designed for the storage and protection of a minimum of 144 optical fibre splices and shall provide access through lockable doors. They shall be fitted with suitable encapsulant that is easily removable, should re-entry be required into the enclosures.

In-line splice enclosures shall be suitable for outdoor use specifications and shall be suitable for tower mounting, with the OPGW cable provided under this contract. The OPTIC SPLICE ENCLOSURES for outdoor installation shall meet or exceed ingress protection class IP66. Splice enclosures shall be appropriate for mounting on EHV Transmission towers above anti-climb guard levels at about 10 meters from ground level and shall accommodate pass-through splicing.

8.0 OPTICAL FIBRE SPLICES

Splicing of the optical fibre cabling shall be minimized through careful contractor planning. There shall be no mid-span splices allowed. All required splices shall be planned to occur within facilities or on tower structures. All optical fibre splicing shall comply with the following :

- a) All fibre splices shall be accomplished through fusion splicing.
- b) Each fibre splice shall be fitted with a splice protection sheath fitted over the final splice.
- c) All splices and bare fibres shall be neatly installed in covered splice trays. No more than six (6) fibres shall be installed in each splice tray.
- d) Attenuation of single mode fusion splices shall not average 0.05 dB and no single splice attenuation shall exceed 0.1 dB when measured at 1310 / 1550 nanometers.
- e) For in-line splicing, fibre optic cable service loops of adequate length shall be provided so that all splices occurring at tower structures can be performed at ground level.

9.0 Methodology for installation and Termination

All optical fibre cable termination, installation, stringing and handling plans, guides and procedures, and engineering analysis (e.g. tension, sag, vibration etc.) shall be submitted to the Employer for review and approval in the engineering/design phase of the project, prior to establishing the final cable lengths for manufacture. Installation procedures including details of personnel and time required shall be documented in detail and submitted to Employer for approval. All installation practices shall be field proven and ISO accredited.

All cable segments shall include service loops. The maximum allowable stringing tension, maximum allowable torsional shear stress, crush strength and other physical parameters of the cable shall not be exceeded. The preventative measures to be taken shall be documented in detail and submitted to Employer in advance of installation.

Optical fibre attenuation shall be measured after installation and before splicing. Any increase in attenuation or step discontinuity in attenuation shall not be acceptable and shall constitute a cable segment failure. In the event of cable damage, the complete span shall be replaced as mid-span joints are not acceptable.

Any or all additional steel work of modifications required to attach the fibre cabling to the overhead transmission/distribution line towers shall also be carried out by the Contractor. The Contractor shall supply all tools and accessories required for installation. It shall be the Contractors responsibility to provide adequate communications among all crew members and support staff to ensure safe and successful installations.

10.0 Installation of Approach Cable :

A network of cable trenches and / of ducts may exist at some sites but shall require expansion and / or new construction at stations. It shall be a responsibility of the Contractor to co-operate fully with the Employer and all other on-going project Contractors in the planning and efficient use of existing and new-construction infrastructure supporting on-station communications cabling.

The existing cable trenches / cable raceways proposed to be used shall be identified in the survey report. The contractor shall make its best effort to route the cable through the existing available cable trenches. Where suitable existing cable trenches are not available, suitable alternatives shall be proposed for Employer's approval. The contractor shall provide any additional outdoor cable raceways and / or cable trenches required for such approved alternative.

It may be noted that in order to utilise the existing trenches, the approach cable may be required to be co-located with HV and LV cables. Accordingly, the approach cable shall be installed in corrosion resistant flexible conduit. Suitable provisions shall be made by the Contractor to ensure adequate safety earthing and insulated protection for the approach cable.

Approach cables existing from the ground or passing through floors shall be protected against mechanical damage.

Approach Cables will be laid within HDPE cable duct throughout from Gantry-joint box to FODP. Approach cables shall penetrate buildings through cable ducts. The cabling shall route within buildings in cable raceways or under raised floors. The Contractor may utilise existing ducts, building penetration, cable trays, racks, etc. where appropriate and approved by the Employer. The cables shall be affixed to cable supports using approved ties, clips or cleats at regular intervals.

On short approach cable runs for which cable supports are not required, the Contractor shall fix the cable to the structure of the building using approved fixing and cable cleats.

The Contractor shall be responsible for new building penetrations required for approach cabling. Caution shall be taken to ensure that existing equipment and site personnel are protected from dust and debris incident to the cable penetration work.

Penetrations shall be neatly formed and sealed for protection from moisture, dust, wind and vermin intrusion.

All required fittings, supports accessories, ducts, inner ducts, conduits, risers and any item not specially mentioned but required for lay and installation of approach cables shall be supplied and installed by the Contractor.

11.0 Cable Raceways:

The Contractor is required to provide and install any additional indoor cable raceways which may be required for proper implementation of the fibre optic cabling system the cable raceways shall conform with the following :

- a) All cable raceways shall be sized to support full loading requirements plus at least a 200% safety loading factor.
- b) Indoor cable raceways shall be fabricated from construction grade aluminium, galvanized iron or anodized sheet metal or any other suitable material approved by the Employer. Suitable anti-corrosion measures shall be provided steel fabricated raceways shall be finished inside and out, treated to resist rust and to form a metal-to- paint bond.
- c) Mechanical construction drawings of the cable raceways shall be submitted for Employer's information and review.

12.0 INSPECTION AND TESTS

12.1 TYPE TESTS:

Type Test for Indigenous or fully Imported Materials:

The offered equipment must have fully type tested as per relevant ISs and / or any other specified international standards, during the last five years period reckoned from the date of opening of the tender. Photocopy of such type test reports/certificates must be submitted along with the tender bid. The type test certificates of prototype manufactured and tested by foreign collaborators of the tenderers at their works shall not be acceptable for indigenously manufactured equipment.

12.2 Inspection

The material for final inspection shall be offered by the Contractor only under packed condition. The employer shall select samples at random from the packed lot for carrying out acceptance test.

Certificate of manufacturing tests shall be maintained by the Contractor and be produced for verification as and when desired by the Employer.

Materials shall not be transported/shipped from its point of manufacture before it has been satisfactorily inspected and tested.

The acceptance of any quality of materials shall in no way relieve the contractor of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

The Contractor shall give the Employer thirty (30) days written notice of any material being ready for testing.

12.3 General Condition for Tests

12.3.1 The entire cost of testing for acceptance and routine test and test during manufacture specified herein shall be treated as included in the quoted unit price of materials.

12.3.2 The Contractor shall submit for the Employer's approval a Test Procedure Specification at least three (3) months before each individual test will be performed. Fully approved test procedures shall be submitted to Employer at least 4 weeks prior to the commencement of testing. The test procedure specification shall specify the details test in accordance with the requirement of this specification.

12.3.3 The Employer reserves the right to require the Contractor to perform any other reasonable test(s) at the Contractor's premises, on site or elsewhere in addition to the aforementioned Acceptance, Routine or manufacturing tests to assure Employer of specification compliance.

12.4 Test Plans

Test Plans and procedures for both factory and field tests shall be provided by the Contractor. Test plans and procedures shall ensure that each factory and field test is comprehensive and verify all the features of the equipment to be tested. Test plans and procedures shall be modular to allow individual test segments to be repeated upon request.

There shall be two factory and field tests shall be submitted for Employer's approval at least three months before the start of testing.

12.5 Factory Acceptance Tests

Factory tests shall be conducted on selected sample of equipment to be supplied. Equipment shall not be shipped until required Factory tests are completed satisfactorily, all variances are resolved, full test documentation has been delivered to the Employer and the Employer has approved for shipment/transportation. Successful completion of the Factory tests and the Employer's approval to ship/transport shall in no way constitute final acceptance of the system or any portion thereof.

Factory tests shall not proceed without the prior delivery to and approval of all test documentation by the Employer. In addition, upon the approval of the test documents by the Employer, the Contractor-supplied maintenance and operators manuals will be used during the tests as guide and as a check that each manual is correct and complete.

1. Acceptance Test of OPGW

10% of all offered items of each LOT shall be selected for witnessing acceptance tests.

A) Tests on finished Cable

- 1) Cable dia
- 2) Attenuation of Fibers at 1310nm & 1550nm
- 3) Attenuation coefficient at water peak
- 4) Chromatic Dispersion
- 5) Cable Cut-off wavelength
- 6) Rated/Ultimate Tensile Strength for 1 Sample from selected OPGW drums/Lot
- 7) Cable lay length & lay ratio
- 8) Rewinding Test
- 9) Cable bend Test
- 10) Weight of Cable
- 11) Strain Margin Test

B) Tests on Aluminium Alloy wires and Aluminium Cladded Steel wires

- 1) Dia of wire
- 2) Tensile strength
- 3) Elongation at break
- 4) Resistivity at 20°C
- 5) Winding/wrapping test for Al. Alloy wires and Torsion test for Al. Cladded Steel wires
- 6) Thickness of Aluminium coating for Al. Cladded Steel wires
- 7) No. of ACS Strands

C) General Tests on Optical Unit

- 1) Total no. of Fibers, No. of fibers per buffer tube & color coding of optical fibers in each tube
 - 2) No. of buffer tubes, colour of buffer tubes, material of buffer tube
 - 3) Aluminium tube (Outer and inner dia)
 - 4) Binding Yarn /Tape (Thermal barrier)
 - 5) Filling Material
 - 6) Strengthening Member (FRP)
-

- D) Chemical compositions of Al. Alloy wire, Al. Cladded Steel wire and Aluminium tube

2. Acceptance Test of OPGW Hardware:

A) Suspension Clamp Assembly

- i) Visual & dimensional verification
- ii) Mechanical Strength (UTS) of the Assembly
- iii) Clamp Slip Strength Test
- iv) Mechanical Strength Test of each component
- v) Electrical Conductivity Test and UTS Test on Outer Rods and Structural reinforcing rods
- vi) Galvanising Test
- vii) Chemical Test to know material composition

B) Tension Clamp Assembly

- i) Visual & dimensional verification
- ii) Mechanical Strength (UTS) of Tension Assembly
- iii) Clamp Slip Strength Test
- iv) Mechanical Strength Test of each component of tension clamp assembly
- v) Electrical Conductivity Test and UTS Test on Dead end Rods and Structural reinforcing rods
- vi) Galvanising Test
- vii) Chemical Test to know material composition

C) Vibration Damper

- i) Visual & dimensional verification
- ii) Calmp slip Test
- iii) Attachment of Weights of Messenger Cable
- iv) Attachment of Clamp to Messenger Cable Test
- v) Clamp Bolt Tightening Test & Clamp Bolt Torque Test
- vi) Vibration Damper Response (Resonant Frequencies) Test and dynamic Characteristics Test
- vii) Strength of Massenger wire Test
- viii) Galvanising Test

D) Down Lead Clamp & Earth Lead Assembly

- i) Clamp Fit Test
- ii) Clamp Strength Test
- iii) Visual Material Verification and Dimensional Check
- iv) Galvanising Test

E) In Line Splice Enclosures (Joint Box) Visual Material Verification and Dimensional Check

3. Acceptance Test of Approach Cable

- i) Physical Check of the cable
 - ii) Optical fiber continuity
 - iii) fiber attenuation with OTDR ($\leq 0.20\text{dB/km}$ @ 1550nm & $\leq 0.35\text{dB}$ @ 1310 nm.
 - iv) Max. Tensile Strength As per IEC60794-1-E1
-

- v) Cable Bend Test As per IEC60794-1-E11
- vi) Repeated Bending Test As per EIA-455-104
- vii) Crush Strength As per IEC60794-1-E3
- viii) Impact Test As per IEC60794-1-E4
- ix) Torsion resistance As per IEC60794-1-E7
- x) Kink Test As per IEC60794-1-E10
- xi) Drip Test on cable As per TEC procedure
- xii) Sheath/Inner Jacket i) Material, ii) Thickness
- xiii) Outer Jacket i) Material, ii) Thickness
- xiv) Armouring i) Material, ii) Thickness
- xv) Rewinding Test
- xvi) Starin Margin Test

12.6 Site Acceptance Tests

During the course of installation the Employer shall have full access for inspection of the progress of the work and for checking workmanship and accuracy as may be required. On completion of the work prior to commissioning, all equipment shall be tested to the satisfaction of the Employer to demonstrate that it is entirely suitable for commercial operation.

The tests shall be carried out in the presence of and to the satisfaction of the Employer by the qualified technical representatives of the Contractor.

Prior to installation every spooled fibre optic cable segment shall be tested for compliance with the Pre-shipment data previously received from the manufacturer. This requirement will preclude the installation of out of specification cable segments that may have been damaged during shipment.

During the installation, spliced cable segments shall be tested and documented. Upon completion of a continuous cable path all fibres within the cable path shall be demonstrated for acceptance of the cable path. Fibre Optic cable field testing minimum requirements are provided in the following tables.

Fibre Optic Cable Pre-Installation Testing

<u>Item</u>	<u>Description</u>
1	Physical Inspection of the cable assembly for damage
2	Optical fibre continuity end-to-end
3	Per fibre OTDR

Fibre Optic Cable Splice Testing

<u>Item</u>	<u>Description</u>
1	Per Splice Attenuation
2	Per splice OTDR
3	Physical inspection of splice box/enclosure for proper fibre routing techniques.
4	Physical inspection of sealing techniques, weatherproofing, etc.

TECHNICAL SPECIFICATION SHEET STEEL DISTRIBUTION BOARDS

1.0 SCOPE

- 1.1** This standard covers the technical requirements of design, manufacture, testing at works and delivery in well-packed condition of Sheet Steel Distribution Boards.
- 1.2** This standard shall be read in conjunction with relevant Specification Sheets and Feeder details.

2.0 STANDARDS TO BE FOLLOWED

- 2.1** The design, manufacture and testing of the equipment shall comply with the latest issue of the following Indian Standards, unless otherwise specified. Equipment complying with equivalent IEC standards shall also be acceptable.

IS: 8623	- Specification for low voltage switchgear and control gear assemblies.
IS: 13947	- Specification for Low-voltage Switchgear and Controlgear IS:
5578	- Guide for marking of insulated conductors.
IS: 11353	- Guide for uniform system of marking and identification of conductors and apparatus terminals.
IS: 10118	- Code of practice for selection, installation and maintenance of switchgear and control gear.

Various components housed in the distribution board shall conform to the Indian Standard Specification as mentioned against the component details.

- 2.2** The design and operational features of the equipment offered shall also comply with the provisions of the latest issue of the Indian Electricity Rules and other Statutory Acts and Regulations. The supplier shall, wherever necessary, make suitable modifications in the equipment to comply with the above.
- 3.0** Wherever any requirement, laid down in this standard, differs from that in Indian Standard Specification the requirement specified herein shall prevail.

3.1 SERVICE CONDITIONS

3.2 Ambient Conditions

These shall be as indicated in Specification Sheet.

3.3 System Details

These shall be as indicated in Specification Sheet.

4.0 OPERATING REQUIREMENTS

The distribution board shall be suitable for operating at the specified rating continuously with the specified voltage and frequency variations under the ambient conditions indicated in Specification Sheet, without exceeding the permissible temperature rise and without any detrimental effect on any part.

5.0 DESIGN AND CONSTRUCTIONAL FEATURES

5.1 General

- 5.1.1 The distribution board shall consist of an assembly of a series of floor mounting, identical, metal clad, dead front type panels of unitized design. The panels shall be placed side by side to form a compact assembly and shall be extensible on either side.
- 5.1.2 The complete assembly shall be dust, damp and vermin proof having minimum degree of protection equivalent to IP-52 as per IS: 13947.
- 5.1.3 The frame work of the cubicles shall be of bolted/welded construction. The minimum thickness of steel shall be 2 mm for load bearing members, 1.6 mm for non-load bearing members and 3 mm for base channel. The doors and covers shall be fabricated from cold rolled sheet steel. Suitable reinforcement, wherever necessary, shall be provided.
- 5.1.4 The door hinges shall be concealed type.
- 5.1.5 All external hardware shall be cadmium plated/zinc passivated. The hardware for fixing the removable parts shall be provided with retaining devices.
- 5.1.6 The doors and the removable covers shall be provided with non-deteriorating neoprene gaskets. Gaskets without any discontinuity shall be preferred. Gaskets shall be held in position in groove of shaped sheet steel work or these shall be of U type. Adhesive cement, if used, shall be of good quality so that the gaskets do not come off during service.
- 5.1.7 All the components shall be accessible for inspection and maintenance without the necessity for removal of the adjacent ones. In case of single front design all components shall be accessible from the front for maintenance and back opening doors/ openable covers for maintenance shall not be acceptable.
- 5.1.8 The layout of the components inside a module shall be liberal to facilitate maintenance and the interconnection of wiring between the components shall not be subjected to any undue stress at the bends.
- 5.1.9 Mounting height of components requiring operation and observation shall not be lower than 300 mm and higher than 1800 mm.
- 5.1.10 Inter panel barriers shall be provided.
- 5.1.11 Adequate arrangement for earthing shall be provided to safeguard the operator or other personnel from electric hazards under all conditions of operation.

5.2 Panel Arrangement

- 5.2.1 The distribution board shall be drawout / non-drawout type in single front/double front configuration as specified in Specification Sheet.
- 5.2.2 Each Panel shall have its horizontal bus-bar chamber running on the top with multi-tier module units in the centre and having vertical bus-bar chamber and cable alley on either side.
- 5.2.3 The modules shall be enclosed on all sides and shall be so arranged that larger ones are placed at the bottom portion of the panel. Fixed type modules shall be at least 300 mm from the base channel.
- 5.2.4 The number of modules in the panel shall not exceed six for motor starter feeders and eight for switch fuse/MCB/MCCB feeders. The minimum size of module shall be 300 mm and 200 mm for starter and switch fuse feeders. The incomer and bus coupler module sizes for ratings up to 400 A shall be half the panel size. For higher ratings they shall be housed in single panel.
- 5.2.5 The module door shall be so interlocked that it shall not be possible to open the door with switch in closed position. Defeat interlock facility shall be provided.

- 5.2.6 The relay, meters, switches and lamps shall be flush mounted. All components of one module shall be mounted on the same module on a rigid sheet steel chassis. A 20 mm dia. rotating knob on the door shall be provided for closing and opening.

5.3 Bus Bars and Connections

- 5.3.1 The bus-bar shall be suitable for the supply system specified in the Specification Sheet. The bus-bar and connections shall be made of electrolytic copper or high conductivity aluminium alloy conforming to Grade E91E of IS: 5082.
- 5.3.2 The bus-bar shall be amply sized to carry the rated continuous current under the specified ambient temperature without exceeding the temperature of 90°C. The bus-bars shall also be designed to withstand the system fault current for 1 second without exceeding the temperature of 200°C for bare aluminium and 250°C for bare copper. The minimum acceptable size of bus-bars shall be 250 sq. mm (Al). Calculation for the bus-bar sizing shall be furnished along with the offer.
- 5.3.3 In case of double front arrangement of distribution boards, different sets of vertical bus-bars shall be provided. The vertical bus-bars shall be PVC sleeved or shrouded by insulating barriers which shall have cut-outs to permit entry of power wires. It shall be possible to remove the shroud for inspection and maintenance. Neutral-bars shall be provided in this chamber.
- 5.3.4 Horizontal bus-bars shall be of same cross-section throughout. Stepped bus-bars shall not be acceptable.
- 5.3.5 All bus-bars shall be arranged and colours coded according to IS: 5578/11353.
- 5.3.6 The horizontal bus-bar shall run in a separate bus chamber located at the top shall have separate screwed cover for inspection purpose.
- 5.3.7 The bus-bars shall be rigidly supported at equal intervals to withstand maximum short circuit stresses. The supports shall be of moulded construction with built in anti tracking barriers. The support material shall be of fibre glass reinforced thermosetting plastic.
- 5.3.8 All joints shall be suitably treated to avoid oxidation of contact surfaces and bimetallic corrosion. A minimum of two bolts with spring washers shall be used for horizontal bus-bar joints.
- 5.3.9 Horizontal bus bars shall be insulated with heat shrinkable PVC sleeves of reputed makes. Insulating shrouds shall be provided for all joints of insulated bus-bars.

5.4 Clearance and Creepage Distances

- 5.4.1 The clearance and creepage distances shall not be lower than the values specified below :
- | | | | |
|-----|---------------------------------------------------------------------|----|-------|
| i) | Minimum clearance between two live conductors | -- | 20 mm |
| ii) | Minimum clearance between live part and accidentally dangerous part | -- | 20 mm |
- 5.4.2 The clearances and the creepage, as specified above, shall definitely be maintained in the bus-bar system. Provision of bus-bar insulations, separator or barriers shall not be considered to reduce the clearance from the values specified above.
- 5.4.3 At the termination points in the equipment, e.g. switches, contactors, thermal relays, etc. it is realized that above clearance shall not always be possible to be maintained. All such points where above clearance are not possible to be maintained shall, therefore, be insulated or taped.

5.5 Insulation

- 5.5.1 The insulation used shall be non-hygroscopic and shall be of porcelain, Epoxy- resins or fibre glass moulded with plastic. It shall be of adequate electrical and mechanical strength to give trouble free service during normal operation and short circuit conditions.
- 5.5.2 The insulation shall be treated suitably to withstand the tropical conditions and atmospheric pollution as specified in Specification Sheet.

5.6 Power Wiring

- 5.6.1 The connections from bus-bar including neutral to individual units on the modules shall consist of PVC insulated flexible copper cable or tapped copper strip.
- 5.6.2 The power wiring size shall be decided based on the rating of the switch, after using a rating factor of not more than 50% over the current rating in free air. In any case the minimum size of power wiring shall not be less than 4 sq. mm copper.
- 5.6.3 The size of connection from incomer to horizontal bus-bar and from horizontal bus-bar to bus coupler shall not be less than the size adopted for horizontal bus-bar.

5.7 Control Wiring

- 5.7.1 The switch board shall be completely factory wired and ready for external connections.
- 5.7.2 The wiring shall be carried out with flexible stranded PVC insulated copper conductor cables of 1100 Volt grade. The size of wires shall be as follows:
 - C.T. Circuit -- 2.5 sq. mm
 - V.T. and Control Circuits -- 1.5 sq. mm
- 5.7.3 All wiring shall be provided with dependent both end marking as per IS: 5578. Numbered ferrules, reading from the terminals outwards, shall be provided at both ends of all wiring for easy identification. These shall be interlocking type plastic ferrules.
- 5.7.4 Control wiring circuits, fed from a supply common to a number of feeders, shall be so protected that failure of a circuit in one feeder does not affect the operation of the other feeders.
- 5.7.5 The wiring to the equipment mounted on the doors shall be carried out with flexible multi strand copper conductor cable and supported so that opening of the door, there is no undue strain on wire leads.
- 5.7.6 The control cables shall be neatly arranged and properly supported.

5.8 External Cable Termination

- 5.8.1 All power and control cables shall enter the distribution board from the bottom unless otherwise specified in Specification Sheet. Sufficient space shall be provided for ease of connection and termination of cables.
- 5.8.2 All cables shall be of 1.1 KV grade PVC insulated armoured and PVC sheathed except for single core cable which shall be unarmoured. The number and sizes of cable shall be as indicated in Feeder details.
- 5.8.3 Compression type cable glands along with the cable lugs as required shall be provided for termination of cables.
- 5.8.4 The cable glands shall be of rolled Aluminium or Nickel/Cadmium plated brass heavy duty

double compression type and shall be mounted on a removable gland plate, provided at a minimum height of 75 mm from the bottom of the distribution board. Two numbers spare knockouts of size 20 mm shall also be provided on the gland plates for future use.

- 5.8.5 For all power cables crimped type aluminium lugs for aluminium cables and tinned copper lugs for copper cables shall be provided.
- 5.8.6 The terminal blocks shall be pressure clamp type up to 35 sq. mm cable and bolted lug type for higher sizes of cables. These shall be protected type and rated for 1100 Volts service. The minimum current rating of terminal block shall be 16 Amp. The construction shall be such that after the connection of cables by means of lugs, necessary clearance and creepage distance are available.
- 5.8.7 Where more than two cables in parallel are required to be terminated, a system of bus links shall be provided with adequate clearance and spacing.
- 5.8.8 Suitable clamps to support the vertical run of cables shall be provided.
- 5.8.9 The terminal block shall be grouped according to circuit functions and suitably numbered. 20% extra terminals shall be provided in the terminal block.
- 5.8.10 For power connections, suitable marking on the terminals shall be provided to identify the phases.

5.9 Feeder Details

- 5.9.1 The requirements of incomer, bus coupler and outgoing feeders shall be as indicated in the single line diagram, feeder details and corresponding schematic diagram.
- 5.9.2 The bus coupler shall be so located that it is possible to maintain half of the bus-bars while the other half is still alive. Complete segregation of bus-bar connections to bus coupler shall be provided.
- 5.9.3 Castle key type mechanical interlocks shall be provided between incomers and bus section modules to avoid paralleling of incomers. In addition padlocking facilities shall be provided in OFF position.
- 5.9.4 Single phase loads shall be distributed as far as possible on all the three phases.

6.0 COMPONENT DETAILS

- 6.1 The make of the components shall be as specified in Specification Sheet and shall conform to type of co-ordination C as per IS: 13947.

6.2 Moulded Case Circuit Breakers

- 6.2.1 The circuit breaker shall conform to IS: 13947 (Part 2) and shall be of P2 category having rupturing capacity as specified in Specification Sheet.
- 6.2.2 The circuit breaker shall be provided with spring assisted quick make quick break type manually operated trip free mechanism, mechanical ON/OFF position indicators, thermal tripping devices of inverse characteristics, instantaneous short circuit tripping devices and necessary auxiliary and alarm switches. The MCCB cubicle shall be provided with service, test and isolated position and automatic safety shutter.
- 6.2.3 The thermal and short circuit tripping device shall be adjustable type.

6.2.4 When used for motor circuit shunt trip devices shall be provided and the let through power of controlling MCCB shall be lower than the respective contactor.

6.2.5 In addition, under voltage trip shall be provided, if specified.

6.3 Switches

6.3.1 The switches shall be Motor duty type AC23 category and shall comply with the requirements laid down in IS: 13947 (Part 3). Switches up to 63 Amps shall be rotary type and those of 100 Amp and above shall be link type.

6.3.2 'ON' and 'OFF' positions of the switches shall be indicated on the panel. Provision shall be made to lock the switch in the 'OFF' position.

6.3.3 The fixed contacts shall be shrouded and the contacts shall be silver plated.

6.3.4 Two Pole switches shall also isolate the neutral circuit along with phase circuit. 4 Pole / 2 Pole switches shall be used for 3 Phase/1 Phase circuits respectively.

6.4 Fuses

The fuses shall be of non-deteriorating HRC cartridge link type and conform to IS: 13703. They shall be suitable for the load and the service required in the circuit.

6.5 Air Break Contactors

6.5.1 The Air Break Contactor shall be of AC3 category unless otherwise specified, conforming to IS: 13947 (Part-4) and flapper type. Gravity operated contactors are not acceptable.

6.5.2 The dropout voltage shall not exceed 65% of rated voltage.

6.5.3 Each contactor shall be provided with auxiliary contacts as required. The rating of the auxiliary contacts shall be 5 Amps. AC or 1 Amp DC at the specified control voltages. The spare auxiliary contacts shall also be wired terminal block.

6.6 Bimetal Thermal Overload Relays

6.6.1 The contactor shall be provided with three pole bimetal thermal overload relays unless otherwise specified. The bimetal relays shall be of suitable range, ambient temperature compensated and shall be separate mounting type. They shall be adjustable through graduated scale and shall be provided with changeover contact.

6.6.2 Bimetal relays shall conform to IS: 3231 and shall have built in single phasing preventor.

6.6.3 The bimetal relays shall be provided with a manual reset device resetable after opening the cubicle door. Auto reset thermal relays are not acceptable.

6.7 Current Transformers

6.7.1 The current transformers shall conform to IS: 2705.

6.7.2 Current Transformers shall be Class-F insulated and vacuum impregnated. The Current Transformers shall be rigidly mounted and shall be easily accessible for maintenance and testing.

6.7.3 The Current Transformers shall be of 7.5 VA output. The output shall be adequate for the instrument and metering duties involved with sufficient margin. The Current Transformers shall have the accuracy Class-1 for the metering duty.

6.7.4 All the Current Transformers shall be provided with terminals and shorting links. One of the terminals of C.T. shall be earthed. The polarity of the C.T. shall be clearly marked.

6.7.5 The C.T.s shall be capable of withstanding momentary open-circuit on the secondary side

without injurious effects.

6.8 Instruments and Meters

- 6.8.1 All instruments shall be flush mounting type with square face and shall be tropicalized and dust tight.
- 6.8.2 The size of the instruments shall be 96 mm x 96 mm for full and half size modules and 72 mm x 72 mm for lower size modules.
- 6.8.3 Dials shall be parallax free with scale marked in black on white background and shall be suitable for direct reading.
- 6.8.4 Zero adjusters shall be provided for operation from the front of the cases.
- 6.8.5 All ammeters and voltmeters shall have 0 - 240° scale moving iron spring controlled type and of Class 1.5 accuracy as per IS: 1248. The scale range of the ammeter and voltmeter shall be as indicated in the feeder details.
- 6.8.6 In case of motor feeders, the ammeter shall be graduated uniformly upto C.T. primary current and with a compressed end scale upto 6 times the C.T. primary current. Red pointer shall be provided, which can be adjusted at site for indicating full load current.
- 6.8.7 KWH meter shall be 3 phase 4 wire type. These shall conform to the requirements of relevant IS and shall be C.T. operated. The current coil shall be rated for 5 Amp.
- 6.8.8 All kWh meters shall be provided with test blocks for current and voltage coils for testing them at site without interrupting their recording while in service.

6.9 Push Button and Control Switches

- 6.9.1 The switches and push buttons shall conform to utilization category AC 11/DC 11 as per IS: 13947 (Part-5). The contact shall be rated to make, break and carry inductive current of 5 Amp. at 415 V AC and 1 Amp at 220 V DC.
- 6.9.2 The control switches shall be spring return rotary type unless otherwise specified and provided with pistol grip type handle. The control switches for circuit breakers shall be additionally fitted with lost motion devices and sequencing devices.
- 6.9.3 The selector switches shall be stay-put rotary type and provided with oval shape handles.
- 6.9.4 The push buttons shall be of momentary contact spring loaded type with a set of normally close and open contacts. The push button for 'Start' shall be shrouded type and coloured green, stop push button shall be un-shrouded type and coloured red and other push buttons shall be un-shrouded type coloured black. The fixing ring shall be metallic white.
- 6.9.5 Emergency stop push buttons, if specified, shall be lockable in pushed position.

6.10 Miniature Circuit Breakers

- 6.10.1 The miniature circuit breakers shall conform to IS: 13032 and shall be of duty category M-9.
- 6.10.2 It shall be provided with overload and short circuit protective devices in a heat resistant housing.
- 6.10.3 A certificate of short circuit rating and current time tripping curve shall be furnished alongwith the offer.

6.11 Signal Lamps

6.11.1 Signal lamps shall be provided to indicate the various circuit conditions as shown in scheme drawings. The colour of the lamps for various functions shall be as follows:

Red	--	Switch/Contactor closed.
Green	--	Switch/Contactor open.

6.11.2 The lamps shall be LED type having lumen output 200 milli candela in axial direction.

6.11.3 It shall be possible to remove the globe from outside for replacement of lamps.

7.0 ACCESSORIES

7.1 The supplier shall include the following accessories.

--	Fuse Puller.
--	Test plug for kWh meters.

7.2 Space Heater

Each vertical section shall be provided with a thermostatically controlled space heater, rated for 240 V, 50 Hz and controlled through double pole miniature circuit breaker.

7.3 Name Plates

7.3.1 The distribution board shall have large name plate on the top to indicate its name and designation.

7.3.2 Each feeder shall be provided with name plate. Each single front panel shall have name plate both in front and back.

7.3.3 All control switches, push buttons, lamps etc. shall have functional identification labels.

7.3.4 Name plate shall be of black perspex with white engraving and of minimum 3 mm thick.

7.3.5 Any other accessories required, but not specified shall also be supplied to make the distribution board complete in all respects to ensure safe and proper operation.

8.0 PAINTING

8.1 The enclosure after degreasing, pickling in acid, cold rinsing phosphatising, passivating etc. shall be painted with two coats of anti-rust paint followed by two coats of anticorrosive paint.

8.2 Epoxy based paint shall be used, if indicated in Specification Sheet.

8.3 All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off, crinkle or be removed by abrasion due to normal handling.

8.4 Unless otherwise specified, the finishing shade shall be light grey Shade No.631 as per IS: 5.

8.5 One litre of paint shall be supplied along with each board for touch up at site.

9.0 TESTS AND INSPECTION

9.1 The distribution boards shall be subjected to routine test as per IS: 8623.

9.2 Additional tests, wherever specified, shall be carried out.

9.3 All the above tests shall be carried out in presence of purchaser's representative. In addition, the equipment shall be subjected to stage inspection during process of manufacture at works and site inspection.

9.4 These inspections shall however, not absolve the vendor from his responsibility for making good any defect which shall be noticed subsequently.

10.0 DRAWINGS AND DOCUMENTS

10.1 Drawings and documents as per Annexure-I shall be supplied unless otherwise specified.

10.2 All drawings and documents shall have the following description written boldly:

- Name of client
- Name of consultant
- Enquiry / Order Number with plant / project name
- Code No. and Description

11.0 SPARES

11.1 Commissioning Spares

Commissioning spares, as required, shall be supplied with the main equipment.

11.2 All spare parts shall be identical to the parts used in the equipments.

12.0 PACKING

12.1 The distribution board shall be properly packed before despatch to avoid damage during transport, storage and handling.

12.2 The packing box shall contain a copy of the installation, operation and maintenance manual.

12.3 A sign to indicate the upright position of the panels to be placed during transport and storage shall be clearly marked. Also proper arrangement shall be provided to handle the equipment.

DOCUMENTATION FOR SHEET STEEL DISTRIBUTION BOARDS

Sl.No.	Documents	Documents Required (Y / N)		
		With Bid	For Approval	Final

1.	Specification Sheet, duly completed	Y	Y	Y
2.	Technical Particulars, duly filled-in	Y	Y	Y
3.	Feeder Details	Y	Y	Y
4.	General Arrangement and Foundation Drawings	Y	Y	Y
5.	Schematic Diagrams with Terminal arrangement drawings	N	Y	Y
6.	Calculation for Bus-bar sizing	Y	Y	N
7.	Illustrative and Descriptive literature	Y	N	Y
8.	Catalogues for bought out accessories	Y	N	Y
9.	Installation, Operation and Maintenance Manual	N	N	Y
10.	Test Certificates			
	-- Type (for MCCB & MCB)	Y	N	N
	-- Routine	N	N	Y
11.	Guarantee Certificates	N	N	Y
12.	Spare Parts List	Y	N	Y

Note:

1. 4 hard copies & 1 soft copy shall be supplied with bid.
2. 4 hard copies & 1 soft copy shall be supplied for approval after order within 4 weeks from the date of LOI.

Earthing & Lightning Protection

1. General

- a. Painting of all earth strip joints with anti-corrosive paints shall be carried out as per details given in drawings and instruction of Owner / Engineer-in-Charge.
- b. All electrical equipment rated 415 V and above shall be connected to earth bus by two separate and distinct earth connections. All equipment rated 240 V and below shall be earthed with single earth conductor.

2. Specifications

- a. All earthing installations shall conform to IS-3043.
- b. Underground conductors shall run at a depth of 600 mm below ground level. Where these conductors run along with cables, they shall be laid at the same depth as cables. Where conductors run on wall, ceilings, they shall be laid on clamps or brackets made out of Al/GI strips.
- c. Wherever, earthing conductor is passing through floor, walls etc. the conductor shall be taken through PVC / GI pipes.
- d. All paints, enamel etc. shall be removed from point of contact before making connections.
- e. Connections between G.I. strips shall be done by welding. For connecting Al conductor / G.I. wire, Al socket shall be crimped on the conductor / wire. At the equipment end, connections shall be done by bolting.
- f. Connection between Al & GI shall be done by bolting. Graphite grease shall be applied on contact surfaces.
- g. Epoxy resin paint or bitumen shall be applied on welded or bolted joints to prevent corrosion and tapping done. Connections between Al wires shall be done by crimping back to back Al ferrule.
- h. Earth electrodes - Earth electrodes shall be provided as per drawings / specification. Work includes excavation of earth, installation of electrodes and test links etc., supply and filling of charcoal and common salt, back filling of earth and removal of extra earth as specified earlier. It also includes making brick wall around the electrode and cover. The testing links shall be grouted on brick wall and connections with earth electrode and conductors shall be made. Distance between two electrodes shall not be less than 10 meters and may be located 4 M away from building foundation.
- i. Earth pits for equipment earthing, neutral earthing and lightning protection shall be separate. However, these pits shall be inter-connected.

3. Design Specifications & Standards:

This specification covers, Design, Engineering of sub-station earthing grid & supply, delivery, installation, testing & commissioning of the same. The earthing grid for sub-station shall be designed in terms of IS:3043 and IEEE Standard Documents Number 80-1986.

For the purpose of finding out actual soil resistivity, it is to be measured in dry season by the successful contractor in presence of the representative of owner. On the basis of actual soil resistivity of the substation earth mat shall be designed accordingly and as per approved earth mat design and approved layout drawing, the substation earth mat shall be laid accordingly. To get the actual soil resistivity of the entire Sub-Station area, to arrive the designed average soil resistivity, measurement shall be done with different number of electrode spacing, preferably in steps of 2, 5, 10, 15, 20/25 meters etc. by following Wenner's four electrode method in line with guide line as laid down. The resistivity for these spacing shall be noted and taken as the resistivity for that particular direction. In a similar manner, resistivities for at least ten locations, covering the entire switchyard area (including control room building), are to be measured. The average resistivity thus obtained shall be used for the design of the earth mat. a) Length of main earth mat conductors, pipe/rod earth electrode and auxiliary mat shall be considered for design purpose of Earthing system. b) The design shall ensure that the grid resistance shall not be more than

0.5 Ω . c) Design shall ensure that potential gradient along the surface during short circuit is limited to a value considered safe for human being. The potential gradient to be achieved shall be less than the safe touch and step voltage.

4. Structure and equipment Earthing:

- a. Two nos. riser flat (above ground) upto apparatus/equipment base directly from the main earthmat rod shall be used for equipment earthing and the same shall run parallel but in opposite direction including loops bonding across structural joints.
- b. Steel/RCC columns, metallic stairs etc shall be connected to the nearby main earthmat grid conductor by two earthing leads. Electrical continuity shall be ensured by bonding different sections of hand-rails and metallic stairs.
- c) Lighting poles, junction boxes on poles and Sub-station, BMK, CT/PT/CVT JB, Cable and cable boxes/glands, lockout switches etc shall be connected to earthing grid conductor at minimum two points.

INSTALLATION OF EARTHING CONDUCTOR LAY OUT :

- (i) The grounding grid shall be constructed by use of corrosion resistant mild steel rod.
- (ii) Wherever earthing conductor crosses cable trenches, underground service ducts, pipes, tunnels, railway tracksetc. It shall be laid 300mm (min) below them and shall be circumvented in case it fouls with equipment/structure foundation.
- (iii) All non-current carrying steel/metal parts in the switchyard shall be connected to the grounding grid including equipment except lightning arrestors, Reactors, power transformers, CVT/PT etc which shall be earthed directly through earth electrode. This electrode shall in turn be connected to earthing grid through galvanised bolts and nut. Each earthing lead from the neutral of the transformer shall be directly connected to two galvanised pipe electrode treated earth pit which in turn shall be connected to station earth grid. Contractor shall submit detail equipment earthing drawing of all equipment along with detail pipe electrode drawing to be used in conjunction with treated pit with test link, treated pit without test link and non-treated pit and structure earthing.
- (iv) All points in steel earthing system shall be made by welding except the points with bolted connection which should be provided for separating the earthing grid for testing purpose. The point for testing purpose should be so placed that the earth grid can be frequently supervised.
- (v) Connection between equipment earthing lead and main earthing conductors and between main earthing conductors shall be welded type. For rust protection, the welded surface shall be treated with Barium Chromate and then Welded surface shall be painted with red lead and coated with two layers of bitumen compound to prevent corrosion.
- (vi) Earth pit of earth electrode without having any test link shall be at least 400x400 mm. in size and 375 mm. deep and earth pit with test link shall be at least 700x700 mm. in size and 375 mm. deep. The earth pit shall be constructed with RCC (M-15) in surrounding wall and floor (minimum wall thickness 125 mm. and floor thickness 100 mm.) with a removable cover slab of 75 mm. thick with RCC (M-15) (0.8% reinforcement by volume of concrete). Cover slab shall be plastered with cement mortar (1:4) on all sides.
- (vii) To provide testing facility with Clip-on type earth resistance measuring meter one test link with ACSR panther conductor having compression type joint with socket of total length of about 300 mm. (combined) shall be incorporated between earth pit and neutral of the Reactor/transformer, CVT/PT/LA, Grid corners etc. which in turn shall be connected to main earth mat. The socket shall be connected with the flat through bimetallic strip. Two earth pits shall be provided for transformer neutral to be connected through two nos. flat. One flat shall be directly connected to one earth electrode through welding and the other flat shall be connected with other earth pit through a testing link. All accessories associated with transformer/reactor like cooling banks, radiators etc shall be connected to the main earthing grid at minimum two points.

- (viii) The earthing conductor around control building shall be buried in earth at a minimum distance of 1500 mm from the outer boundary of the building and which in turn shall be connected to switchyard main earth grid conductor as per approved earthing lay out drawing for control room to be submitted separately.
- (ix) Steel to Copper connection if any shall be brazed type and shall be treated to prevent moisture ingress.
- (ix) Bending of earthing rod shall be done preferably by gas heating.
- (x) All ground connections shall be made by one welding except the point with bolted connection which should be provided for separating the earthing grid for testing purpose. The point for testing purpose should be so placed that the earth grid can be frequently supervised for rust protection, the welded surface shall be protected with bitumen paint riser (M.S. Flat) above ground shall be painted with Zinc rich paint above anti Oxide primer. All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load to it. Artificial cooling shall not be allowed.
- (xi) All C & R panels, PLCC and its Battery charger shall be earthed by 50×8 mm GS Flat (2 nos flat one each on opposite side) to MS earth Bus of 50 x 8 mm. MS Flat runs on the top of the tier and all along the cable trenches and the same shall be welded to each of the racks. Further this Flat shall be earthed at both ends at an interval of 30 mtr. The MS Flat shall be finally painted with two coats of Red oxide primer and two coats of bitumen compound.
- (xii) Earthing conductor for main ground grid in outdoor areas shall be buried at least 600 mm below finished ground level or more as per design consideration for green field Sub-Station. For existing substation it should be laid matching with existing earth mat grid level.
- (xiii) Earthing conductor or leads along their run on cable trench, ladder, wall, etc. shall be supported by suitable welding / cleaning at interval of 1200 mm. Wherever it passes through walls, floors, etc., galvanized steel sleeves shall be provided for passage of conductor and both end of sleeves shall be sealed to prevent passage of water through sleeves.
- (xiv) Earthing conductor, i.e. grid perimeter ground conductor shall be buried 1000 mm (min.) outside the switchyard fence. All gates of every alternate post of fence shall be connected to earthing grid. Gravel / crushed stone spreading shall also be done 1000 mm (min.) outside the switchyard fence. However criterion of gravel / crushed stone spreading shall be followed in line with requirement of approved drawing & schedule of works.
- (xvi) Flexible earthing connectors shall be provided for moving parts.
- (xvii) Tap connection from earthing grid to equipment / structures to be earthed shall be terminated on the earthing terminal of the equipment/structures as per approved drawings.
- (xviii) Auxiliary earth mat of same dia of the main earth mat and total size 1500×1500 mm with 500×500 mm closely spaced conductor shall be provided at a depth of 300 mm from the finished ground level below the operating handle of MOM box of all isolators. MOM box shall be directly connected to auxiliary mat which in turn shall be connected to main earth mat grid at two points.
- (xix) As stated in clause 5.0 above, the earth mat design shall be based on uniform spacing method. However closely spaced corner mesh shall be provided at all corners of the main earth mat in addition to main earth grid conductor to minimize ground potential rise and to control perimeter gradients and step potential, two or more parallel conductor of same dia of main earth mat shall be buried all along the perimeter.

- (xx) All above ground conductive metal parts that might accidentally energized shall be connected to main earthmat.
- (xxi) Pipe electrode shall be used in the following area (application wise) : a) Pipe electrode in treated pit with test link (Test pit) : Application: Reactor/Power Transformer's Neutral, Earthing Transformer/ Station Service Transformers' Neutral, Grid Corner, LA, CVT, PT. b) Pipe electrode in treated pit without test link : Application: Lightning Mast, Shield wire down comer, Control room building / Integrated GIS building corners.
- c) Rod Earth electrode in non-treated pit : Application: Coupling Capacitor, Grid periphery (other than grid corner).
- (xxii) The crushed stone/gravel spreading shall be restricted to main earthmat area of the switchyard.
- (xxiii) Earthing conductors crossing the road shall be laid 300mm below road or at greater depth to suit site condition.
- (xxiv) Earthing conductors embedded in the concrete shall have approximately 50mm concrete cover.

CABLE TRAYS

1. Prefabricated perforated Al cable trays and its accessories such as coupler plates, risers, bends etc. shall be fabricated from 4.0 mm thick Al sheets.
2. The finished tray and accessories shall be free from sharp edges and corners, burrs and unevenness.
3. Each straight length and bed shall be supplied with two coupling plates fitted at each side channel at one end. The couplings plates shall be complete with bolts, nuts and washers fitted at other four holes for fixing to adjoining member. Coupling plate shall be designed to permit longitudinal adjustment up to ± 10 mm and skew up to 10° .

ABT METERS TECHNICAL SPECIFICATIONS

ABT Meters should comply following technical specifications.

- 0.2S accuracy for active and reactive measurement.
- Make – Secure Meters – For seamless integration with existing ABT(Secure) Meters.
- Wide-range dual auxiliary supply with options for AC/DC and self-power (VT powered)
- Power quality features including THD, sag, swell, voltage unbalance and interruption recording
- Dynamic error compensation for CT/VT
- Transformer/Line loss adjustment (Copper and Iron losses)
- Intuitive graphical display including vector diagram, wave forms and bar chart for consumption
- Remote configuration of communication ports
- Support of meter reading/display over field replaceable battery
- In built IEC61850 along with RS232/RS485 and Ethernet ports in a single product & capability of simultaneous communication through all these ports
- Simultaneous DLMS and MODBUS over Ethernet port
- Flexible time-of-day tariff, maximum demand support with automatic billing dates
- Meter cover and terminal cover open detection
- RS232 port compatible with meter-powered modem

Table : Technical Specifications

Electrical	
Connection type	HV3/HV4
Measurement voltage range	57.7 V or 63.5 V (L-N) for HV4, 100 or 110 V (L-L) for HV3
Measurement current range	Ib: 1A or 5A (configurable)*, I _{max} up to 10A (configurable)*
Frequency	50 Hz \pm 5%
Burden with auxiliary/self (VT) powered	Current circuit: < 0.1 VA/phase @ 1A, < 0.5 VA/phase @ 5A Voltage circuit in case of Aux power: < 0.1 VA/phase Voltage circuit in case of internal/self power: < 6 VA/phase
Accuracy	Class 0.2S
Maximum overload Voltage	1.5 times of nominal voltage continuously 2 times of nominal voltage for 0.5 second
Maximum overload current	1.5 times of I _{max} continuously 10 times I _{max} for 1 second 20 times I _{max} for 0.5 second
Compliance	
Standards*	IS 14697 IS 15959 DLMS Indian companion standard, category B
Mechanical	
Dimensions (W x H x D)	292mm x 201mm x 105mm (H x W x D)
Weight	2 kg (+/- 200 gm)
Environmental	
Ingress protection	IP54
Operating temperature	-10 °C to + 60 °C
Limit range of operation	-25 °C to + 70 °C
Storage temperature	-40 °C to + 80 °C
Temperature coefficient	<0.1%/10 C

Type Test

The vendor shall submit the type test reports as per relevant IEC/ International standards for the offered make/model to the employer. It is completely on the discretion of the end customer to accept/ repeat the type test report. No price implication shall be entertained during contract stage/ later stage for respective type test repetition.

Packing And Dispatch

1. All equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site. While packing all the materials, the limitations from the point of view of availability of transportation facilities in India should be taken into account. The Bidder shall be responsible for any loss or damage during transportation, handling and storage.
2. The Bidder shall include and provide for security, protection and packing the equipment so as to avoid loss or damage during transport by any mode.
3. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols i.e. FRAGILE, HANDLE WITH CARE, THIS SIDE UP etc. along with WEIGHT, OWNER PARTICULARS/ PO Nos.

4. Any material found short inside the packing cases shall be supplied by the Bidder without any extra cost.
5. The packing, marking and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract and, subject to any subsequent instruction ordered by the Employer.

Energy Metering Panel

Construction

- 01 The Metering Panels shall be totally enclosed, floor mounted free-standing, dead-front assemblies with IP42 degree of protection. Instruments/meters shall be mounted on the panel with annunciator windows on the top. All control switches, selector switches etc. shall be suitable for mounting on mosaic grid.
- 02 Design, material selection, and workmanship shall be such as to present a neat appearance outside and inside with no welds, rivets, screws or bolt heads apparent from the exterior surface of the Boards. The boards shall have a smooth and uniform matt finish, free from scratches, dents and other imperfections.
- 03 The panels shall be liberally sized so as to provide spacious layout of equipment and devices with sufficient working space in between.
- 04 Each board may consist of a number of panels mounted side-by-side, in which case, these shall be bolted together to form a compact unit. Where two panels meet, the joints shall be smooth, close-fitting and unobtrusive.
- 05 The boards shall be of folded sheet steel construction, assembled on channel/angle base plates with anti-vibration mountings.
- 06 The boards shall be fabricated of minimum 2 mm thick sheet steel, free from all surface defects. The boards shall have sufficient structural reinforcement to ensure a plane surface, to limit vibration and to provide rigidity during shipment and installation.
- 07 All doors and removable covers shall be provided with neoprene gaskets all around and latches sufficiently strong to hold them in alignment when closed. The door operating handle shall have locking arrangement.
- 08 All panels shall have rear door with concealed type hinges and pad-locking arrangement. Doors shall be grounded by flexible copper braid. Two-point earthing shall be provided in each panel.
- 09 The boards shall be complete with vibration damping pads, stainless steel kick plates, floor channel sills, anchor bolts, and other necessary hardware for mounting.

Equipment Mounting

- 01 All instruments, switches, etc. mounted on the front face of the panels shall be flush or semi-flush type. The relay panel shall have complete glass door in the front and relay mounting frame shall be inside the glass door. The mounting frame shall be hinged type front operable.
- 02 No equipment shall be mounted on panel door.
- 03 All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.

- 04 All equipment inside the panels shall be so located that their terminals and adjustments are readily accessible for inspection or maintenance.
- 05 In case cut-outs are provided on any panel for future mounting of equipment, the same shall be properly blanked off.
- 06 Working height shall be limited between 450mm and 1200mm from floor level.

A.C. / D.C. Power

- 01 Supply 2.05.01 Necessary A.C. and D.C. supplies to each protection panel, as required for service, shall be arranged by the Bidder. Single feeder may be arranged for A.C. supply but duplicate feeders shall be arranged for D.C. supply. These switches shall be mounted inside the panel.
- 02 Alarm relays with reverse flag shall be provided to annunciate failure of main incoming A.C. and D.C. supplies and annunciation D.C. supply in each panel. Lamp indications shall be provided individually for main D.C. supply-1 fail, main D.C. supply-2 fail, and panel annunciation D.C. supply fail. A common A.C electric bell shall be provided to give an audible alarm in case of failure of D.C. supply-1/D.C. supply2/annunciation D.C. supply in any panel. A common push-button shall also be provided for cancellation of lamp indication and audible alarm.
- 03 MCB shall be provided for the incoming A.C./D.C. power supplies. Bus wires shall be run for power distribution to different panels. Power supply isolation switches shall be 4-pole, single throw, for A.C. (considering single feeder) and 2-pole, double throw with OFF for D.C.
- 04 Fuse and link shall be provided for individual circuits for protection and also for isolation from bus wire without disturbing other circuits.
- 05 The fuse requirements in each panel shall be grouped in easily accessible fuse locks or distribution panel. The groupings shall be done in a neat and orderly fashion.

Wiring

- 01 Each panel shall be fully wired at the factory to ensure proper functioning of protection and metering schemes.
- 02 All spare contacts of relays and switches shall be wired up to terminal blocks. All interconnections between the panels shall be furnished.
- 03 Wiring shall be done with flexible, FRLS (fire resistant low smoke), 750 / 1100V grade, PVC insulated; switch board wires with stranded copper conductor. The minimum size of the wires shall be 2.5 Sq. mm. for current & voltage circuits and 1.5 Sq. mm. for control circuits. However, CT circuits with 5A secondary shall be wired with 4sq.mm copper conductor as a minimum.
- 04 Each wire shall be ferruled by plastic tube with indelible ink print at both end having terminal block no., terminalno. as per approved wiring diagram. Interlocking type ferrules shall be used for identification. A.C. /D.C. wiring shall have separate color coding.
- 05 All wire terminations shall be made with insulated sleeve, solderless type tinned copper lugs. Wire shall not be tapped or spliced between terminals.
- 06 Wiring shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on the termination.

Terminal Block

- 01 All internal wiring is to be connected to external equipment shall terminate on terminal blocks. Terminals shall be 1100V grade and have 10Amps continuous rating, moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and locknuts. Marking on terminal blocks shall correspond to wire number and terminal numbers on wiring diagram. All wiring meant for power supply to transducers, recorders shall be suitably fused or designed to limit short circuit currents. Means for detection of blown or open circuited fuses shall be provided.
- 02 Disconnecting type terminal blocks for current and Voltage transformer secondary leads shall be provided. Terminals for C.T. secondary leads shall have provision of shorting and earthing. All PT circuits shall be provided with HRC fuses having special holders such that they cannot be interchanged with other types of fuse holders and other fuse holders cannot be introduced within them.
- 03 Not more than two wires shall be connected to one terminal. If necessary, a number of terminals shall be jumpered together to provide wiring points. Separate terminal blocks shall be used for A.C./ D.C. wiring termination.
- 04 Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side
 - All CT : 4 Sq. mm. Cu
 - All PT circuits : 2.5 Sq. mm. Cu
 - A.C./D.C. Power supplies Circuits : 6 Sq. mm. Cu
 - All other circuits : minimum 2x 2.5 sq. mm. Cu
- 05 Each terminal shall be identified with designation as per approved schematic. Spare terminals equal in number of 20% active terminals shall be furnished.
- 06 The wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- 07 The terminal blocks shall be located to allow easy access and also to suit floor openings for cable entry.
- 08 Unless otherwise specified, terminal blocks shall be mounted vertically with adequate spacing (not less than 100mm) between adjacent rows. The insulation between any two terminals and terminal to frame work shall withstand 2kV rms for one minute.
- 09 The bottom of the terminal block shall be at least 200mm above the incoming cable gland plate.

Cable Entry

- 01 The panels shall have provision of cable entry from the bottom. Bottom plate shall be provided to make entry dust-tight.
- 02 The panels shall have provisions inside for fixing the multi-core cable glands. Cable glands shall be double compression type. Cable gland support plate shall be 4mm thick and mounted not less than 200mm above floor level.

Grounding

- 01 50x6mm tinned copper ground bus shall be provided in each panel, extending along the entire length of the assembly. All the panels shall be equipped with a continuous earth bus with connectors and clamps between panels for inter-panel connection of the earth bus. All the metallic cases of relays, instruments and other panel-mounted equipment shall be connected to the earth bus by 2.5 sq.mm copper wires. CT and PT secondary neutral or common lead shall be earthed at one point only at the terminal block and such earthing shall be made through links. Separate copper earthing shall be made through links. Separate copper earthing flat shall be provided in the panel for cable screens of static equipment.
- 02 The ground bus shall have two-bolt drilling with GI bolts and nuts at each end for connection to the station earthing system.
- 03 The ground bus shall be bolted to the panel structure and effectively ground the entire assembly. The cases of meters, relays and switching devices shall be grounded through the steel structure

132 KV BAY – SCOPE (DESIGN, PROCUREMENT, TESTING, INSTALLATION, COMMISSIONING)

1.0 GENERAL

1.1 Scope

- 1.1.1 This standard covers the technical requirement of detailed installation, design engineering, manufacturing & testing of equipments at works, supply, erection, painting, testing, and commissioning of all the required equipments and accessories at site for Extra High Voltage Switchyard.
- 1.1.2 The scope of work shall cover all the equipment and accessories required for the completeness of the switchyard.
- 1.1.3 This standard shall be read in conjunction with the relevant specification sheets (SS) and other relevant reference as specified there in.
- 1.2 Inclusion of Work
This shall be as indicated in specification sheet (SS).
- 1.3 Exclusion of Work
This shall be as indicated in specification sheet (SS).
- 1.4 Service by Owner
These shall be as indicated in specification sheet (SS).
- 1.5 Ambient Conditions
- 1.5.1 For the purpose of design of electrical equipment / installation, the ambient conditions shall be as indicated in specification sheet (SS).
- 1.5.2 The equipment / installation shall be suitable for trouble free operation in the specified ambient and atmospheric conditions.
- 1.6 System Details
- 1.6.1 The details of owner's power supply system shall be as indicated in specification sheet (SS).
- 1.6.2 The control system shall be so designed that mal-operation of coils do not occur due to long distance between the operating coils and interlocking devices.
- 1.7 Reference Standards
- 1.7.1 All electrical equipment to be supplied shall comply with the requirements laid in the relevant Indian Standard Specifications. Equipment complying with equivalent IEC standards shall also be acceptable. In case of any difference between this standard and relevant ISS / IEC, the feature specified here-in shall prevail.
- 1.8 Rules & Regulations
The electrical equipment offered and their installation shall also comply with the requirement of the latest issue of the following statutory rules / regulation.
 - The Indian Electricity Rules
 - The Indian Electricity Act
 - The Indian Factories Act
 - The Fire Insurance Regulations
 - Any other State / Country regulation in forceThe supplier shall make suitable modifications, addition/alteration in the equipment, wherever necessary, to comply with the above mentioned Acts/ Rules/ Regulations, free of cost.
- 1.9 Tests & Inspection
- 1.9.1 The vendor shall allow and provide necessary facilities to the owner's Inspector at the manufacturer's works for stage and final inspection for all items.
- 1.9.2 The vendor shall carry out all routine tests, type tests and special tests, if any as per relevant Indian Standards or as may be called for by the Inspector. All the above mentioned tests shall be as carried out in the presence of purchaser's representative.
- 1.9.3 The despatch of the item shall be subject to inspector's written consent of successful testing and acceptance by him.
- 1.9.4 These inspections / approval shall, however, not absolve the vendor from his responsibility for

making good any defect which may be noticed subsequently.

1.10 Erection, Testing & Commissioning

1.10.1 The vendor shall undertake erection of all electrical equipment in accordance with established practices in conformity with statutory regulations and to the entire satisfaction of the owner.

1.10.2 The vendor shall arrange all the necessary erection tools, tackles, testing and measuring instruments and shall supply required erection materials.

1.10.3 The vendor shall obtain the necessary clearance from the Electrical Inspector for equipment supplies and installation. All necessary drawings and test certificates as required by the Inspector shall be furnished. Any modification required by Electrical Inspector shall be carried out without any commercial implications to owner.

1.10.4 All pre-commissioning tests as prescribed in relevant ISS/ equipment manufacturer shall be carried out and properly recorded and submitted to Site Engineer.

1.10.5 Following testing shall be specifically conducted before commissioning in presence of owner's representative. All the test results shall be recorded and submitted to the site Engineer.

- Insulation test
- Continuity test
- High voltage test
- Simulation test
- Ratio tests of CTs and PTs
- Sec. Injection tests of Protective Relays
- Accuracy check of all Meters and Instruments.

1.11 Drawings & Documents

1.11.1 The vendor shall supply the drawings and documents as per list of documents attached with Specification Sheets (SS) / Engineering Standards.

1.11.2 At the time of handing over of the installation, the vendor shall supply as built drawings taking into consideration the actual execution carried out at site.

1.11.3 All drawings and documents shall have the following descriptions written boldly:

- Name of client
- Name of consultant
- Enquiry / order number with plant / project name
- Equipment Code No. and Description

1.12 Spares

1.12.1 Spares for operation and maintenance

Item wise unit prices of spare parts as listed in specification sheets with recommended quantity shall be quoted along with the equipment. All other essential spares to be kept in stock at all times shall also be quoted

1.12.2 Commissioning Spares

Commissioning spares, as required, shall be supplied with the main equipment. Item wise list of recommended commissioning spares shall be furnished for approval.

1.12.3 Any other spare parts not specified, but required, shall also be quoted along with the offer.

1.12.4 All spare parts shall be identical to the parts used in the main equipment.

1.13 Make of Equipments

The Make of all the electrical equipment shall meet the requirements of the specific project.

1.14 Co-ordination with Others

The vendor shall co-ordinate with owner's other vendors / agencies, where required, and shall freely and readily exchange all technical and other information required for proper co-ordination.

1.15 Deviations

1.15.1 Deviation, if any, from this standard shall be clearly indicated in the offer with reasoning.

1.15.2 Deviations, if any, from the data furnished in Specification Sheet (SS), shall be clearly indicated in the offer beside the data by encircling the same.

2.0 EQUIPMENT / ACCESSORIES SPECIFICATION

2.1 General

- 2.1.1 All electrical equipment shall be enclosed in dust, damp and vermin proof enclosure equivalent to IP-54. In addition they shall be weather proof.
- 2.1.2 Special care shall be taken to ensure that the parts to be opened for inspection and maintenance retain their dust tightness even after repeated opening and closing.
- 2.1.3 All mating surfaces shall be properly machined. Neoprene gaskets shall be used for dustproofing. The gaskets shall be without any joints / gaps.
- 2.1.4 Only non-hygroscopic materials shall be used for insulation. All insulation shall be specially impregnated to with-stand ambient conditions and atmospheric pollution.
- 2.1.5 All live parts shall be adequately protected to prevent inadvertent or accidental contact.
- 2.1.6 Only hexagonal head fasteners shall be used. These up to 8 mm dia shall be of stainless steel and above 8 mm shall be of MS-cadmium plated or Zinc-passivated.
- 2.1.7 The outside surface of all equipment shall be painted after suitable pre-treatment by the application of two coats of rust and corrosion resisting epoxy based paint. The final shade shall be as indicated in Specification Sheet(SS).
- 2.1.8 2 Nos. earthing terminals complete with sockets and identification marks shall be provided on the enclosure of all electrical equipments.
- 2.1.9 All equipment shall be provided with stainless steel name plates containing the relevant particulars along with the description of the Equipment and their respective Code Nos.
- 2.1.10 All the electrical equipment to be connected with cable glands shall be provided with Heavy duty double compression type cable glands and Cu / Al crimping lugs suitable for the cable sizes required.

2.2 Circuit Breakers

The SF6 circuit breakers and associated accessories shall generally conform to the latest issues of the following standards as given below, except to the extent explicitly modified in this specification.
IS-13118: Specification for HV AC Circuit Breakers. IEC-Pub 56: Specification for HV AC Circuit Breakers.

IS-13072: Specification for Sulphur Hexafluoride for Electrical Purpose. IEC-Pub 376: Specification for Sulphur Hexafluoride for Electrical Purpose. IS-2099: Specification for bushing above 1kV AC
IEC 62271-100

SF6 Circuit Breaker of ABB/Areva/Siemens make to be provided.

- 2.3 Isolators & Earthing Switches
These shall be in conformity with the Specification Sheets and 5003-TS-0830.
- 2.4 Potential Transformers
These shall be in conformity with the Specification Sheets and 5003-TS-0831.
- 2.5 Current Transformers
These shall be in conformity with the Specification Sheets and 5003-TS-0832.
- 2.6 Lightning Arresters
These shall be in conformity with the Specification Sheets and 5003-TS-0833.
- 2.7 Power Transformers
These shall be in conformity with the Specification Sheets and 5003-TS-0801.
- 2.8 Neutral Earthing Resistor
These shall be in conformity with the Specification Sheets and 5003-TS-0802.
- 2.9 Control, Relay & Metering Panel
These shall be in conformity with Specification Sheets.
- 2.10 Insulators
- 2.10.1 The design manufacture and testing of insulators and their accessories shall comply with the latest issue of IS-731, IS-2486, IS-2544 and other relevant standards.
- 2.10.2 General design features
 - i) Post insulators shall be of cap & pin type and strain insulators shall be single string / combination of two or more strings consisting of cap & pin type/ interlink type insulator disks.

- ii) Each insulator shall be supplied complete in every respect. Sufficient number of postinsulators shall be provided for bus bars jumper supports etc. The strings shall have strained disks with breaking strength not less than 6800 Kg. The strings shall be complete with galvanised hardware and arcing horns on line side.
- iii) For suspension insulators used for jumpers, bolted type suspension clamps shall be provided. For string and bus bar connection, suitable type of strain clamps (other than bolted) shall be provided for Aluminium conductors. Clamps & connectors shall have good mechanical strength to withstand dynamic loads, resistant to corrosion and free from corona & radio/television interference. Temperature rise of clamps & connectors shall be less than that of associated bus bar / conductors.
- iv) The insulator shall be anti-fog type, unless otherwise specified.
- v) The porcelain used shall be manufactured by the wet process and shall be of homogeneous structure free from lamination, cavitation or other flaws affecting its mechanical or dielectric strength. It shall be well vitrified and shall have chocolate coloured glaze for post insulators and brown coloured glaze for strain insulators. Each cap shall be of high grade cast or malleable iron casting or steel forging. All ferrous parts shall be hot-dip galvanized.
- vi) The minimum creepage distance for insulators shall be as per relevant standards, but it shall not be less than 50% of the gap between the lines.

Tests

- i) Routine test, as per relevant ISS, shall be carried out on each unit.
- ii) Type test shall be carried out, as per relevant ISS, in one of the insulators of each type.

2.3 Bus Bars & Bus Bar Connections

- 2.11.1 Conductor Sizes The conductor for bus bars shall be Aluminium and of specified size and construction in accordance with the latest Indian Standard Specification. The size of the jumpers shall be same as bus bars.
- 2.11.2 Temperature The total temperature for bus-bars and bus-bar connections at the specified ambient temperature, when carrying rated normal current at rated frequency, shall not exceed 80°C.
- 2.11.3 Clearances The net clearances in air for bus bars, jumpers etc., shall not be less than the stipulations indicated in Specification Sheet (SS).
- 2.11.4 Bus-bar deflection The deflection of the bus bars supported on post insulators should not exceed half the diameter of the bus-bars or $L/14.4$ cm (where L is the span in meter), whichever is lower.
- 2.11.5 Mechanical Strength i) The bus-bars and bus-bar connections shall be so supported and proportioned as to be capable of safely withstanding stresses to which they may be subjected, including those due to short circuit and climatic conditions. ii) It shall be designed so as to resist the prevalent wind velocity on the projected area.
- 2.11.6 Thermal Expansion Provision shall be made, where necessary, to allow for expansion and contraction of busbars and bus-bar connection caused by temperature variations.
- 2.11.7 Clamps i) The clamps required for connection shall be designed in such a way that the contact resistance is minimum and that no soldering is required for any of the connections. The clamps shall be designed to give sufficient pressure on the conductors to make good electrical contact. Expansion couplers shall be used to compensate for longitudinal movement of conductors. ii) Suspension clamps shall be so designed that the effects of vibration, both on the conductor and fitting itself are minimized. Sharp radius of curvature, ridges etc., which might lead to localized pressure on or damage to the conductor in service shall be avoided. The clamp shall permit the conductor to slip before the failure of the conductor occurs. The fittings shall have sufficient contact surface to minimize damage due to fault currents.

2.12 Earthing & Lightning Protection

- 2.12.1 The earthing of equipment and neutral shall be carried out as per IS-3043, I.E. Rules and IEEE-80. The earthing of fence shall be as per established practices. The lightning protection shall be as per IS/IEC-62305.
- 2.12.2 The earthing mat shall be so designed that:
 - i) The overall earth resistance in dry weather condition is less than 1 ohm.
 - ii) A factor of safety of 2 shall be maintained between the calculated step / touch potential during fault and the tolerable step / touch potential.
- 2.12.3 The materials to be used as earthing connections shall be of hot dip galvanized having a minimum average surface coating of 800 gm/m².
- 2.12.4 The zone of protection against lightning strokes shall be 300 for equipment and 450 for bus-bars.
- 2.12.5 The earth pits for equipment earthing, neutral earthing and lightning protection shall be separate but interconnected.
- 2.13 Lighting and Other Auxiliaries
 - 2.13.1 Scope

The scope shall include but not limited to the following:

 - i) Auxiliary service power board (ASPB)
 - ii) Sub-distribution board
 - iii) Lighting fixtures complete with lamp / tubes
 - iv) Switch sockets with plugs
 - v) Cable and wiring
 - vi) Junction boxes
 - vii) All other items as required
 - 2.13.2 Design requirement of Illumination System
 - i) An illumination level of 40 Lux (Guaranteed) shall be maintained throughout the switchyard after considering maintenance factor as 0.6 and utilization factor and coverage factor as applicable.
 - ii) The lighting load shall be distributed equally in all three phases.
 - iii) The group control system of lighting shall be adopted.
 - iv) The lighting shall be automatically switched 'ON' and 'OFF' by means of suitably located photocell / timer.
 - v) Each circuit shall have maximum loading of 1000 watt.
 - vi) The plug sockets shall be fed from separate circuit.
 - vii) Maximum four numbers of plug sockets shall be connected in one circuit.
 - viii) The voltage drop in any branch circuit shall not exceed 2%.
 - 2.13.3 Auxiliary Service Power Board
 - i) For supply to all lighting circuit, plug circuits, welding outlets, space heater, main transformer cooling fans, one number distribution board rated for 415V, 400A, 3 phase 4 wire is foreseen and shall be located in the switchyard.
 - ii) The switch board shall have dust, damp and vermin proof enclosure equivalent to IP-55 as per IS: 13947 and suitable for outdoor use. In addition, it shall be weatherproof.
 - iii) The board shall be floor mounting type, unitised in construction with feeder compartments in multi-tier formation. Not more than 6 feeders shall be provided in one panel.
 - iv) The board shall be fabricated out of 2 mm thick sheet steel provided with continuous neoprene gasket to make the board complete dust proof.
 - v) The incoming to the board shall be provided with heavy duty switch, link type cartridge fuses, contactor, ammeter with selector switch and voltmeter with selector switch. The outgoing to the board shall have components as required.
 - vi) The switches shall be of AC-23 type as per IS: 13947 and interlocked with the door.

However, a defeat interlock mechanism shall be built-in.

- vii) The fuses shall be HRC type and class 2 AC as per IS: 13703.
- viii) The contactor shall be of AC 3 category as per IS: 13947 and rated for 240/ 110 V AC. The contactors for the two incoming feeder shall be interlocked so that it shall be possible to connect one of the incomers to the bus-bars. Automatic transfer of incomers should take place in case of failure of the service incomer. Necessary selector switches and facilities for testing/ maintenance shall be provided.
- ix) All components except bus-bars shall be mounted vertically.
- x) Horizontal and vertical run of bus-bar shall be located in separate chambers in the distribution board. Each bus-bar shall be supported separately. The bus-bar shall be rigidly supported at an interval of not more than 400 mm. The bus-bar supports shall be of ribbed construction of paramali, fibre glass or melamine. Insulating barriers shall be provided between bus-bar chamber and each compartment.
- xi) The connection from bus-bar to individual compartment units shall pass through bushed holes.
- xii) The minimum clearance and creepage distance between phases and between phases to earth shall not be less than 20 mm and 28mm respectively through out the bus-bar system.
- xiii) The switch board shall be supplied with cadmium plated external hardware, two nos. earthing terminals, rolled aluminium double compression cable glands, pressure clamp terminal up to 63 Amps and crimping lugs for more than 63 Amps

Note : In addition with the Technical Specifications mentioned above, For Technical specifications of Equipments. – Standards as per PGCIL or BSPTCL shall stand valid and same to be referred in terms of any reference.

ANNEXURE – V(B) (PART B)

**TECHNICAL SPECIFICATIONS
FOR COMMUNICATION
SYSTEM**

Section-1
Introduction, General Information and General Requirement

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Section 1

Introduction, General Information and General Requirement

This Document describes the technical specifications for Communication Equipment for Establishment of Fibre Optic Communication System under the contract. This specification describes the functional and performance requirements of the system.

All the specifications specified should be marked as reference while supply and job execution, however these specifications may vary as per the site requirements

1.1 Scope and General Requirements

The broad scope of the procurement of this part include the survey, planning, design, engineering, supply, transportation, insurance, delivery at site, unloading, handling, storage, installation, termination, testing, training, and demonstration for acceptance, commissioning and documentation for:

- (i) SDH, DCU Equipment along with suitable optical line interfaces & tributary cards.
- (ii) Craft Terminal based Network Management System(NMS)
- (iii) All cabling, wiring, Digital Distribution Frame patch facilities and interconnections to the supplied equipment at the defined interfaces.
- (iv) System integration of the supplied subsystems and also integration with existing communication equipment such as SDH
- (v) Integration of supplied system with the User equipments such as RTUs, system etc.
- (vi) Maintenance of the supplied system

All other associated works/items described in the technical specifications for a viable and fully functional communication network.

1.2 General Requirements

The Contractor is encouraged to offer standard products and designs. However, the Contractor must conform to the requirements and provide any special equipment necessary to meet the requirements stated herein.

It should be noted that preliminary design information and bill of quantity (BoQ) specified in this specifications are indicative only. The Contractor shall verify the design data during the site surveys & detail engineering and finalise the BoQ as required for ultimate design & system performance.

The Bidder's proposal shall address all functional and performance requirements within this specification and shall include sufficient information and supporting documentation in order to determine compliance with this specification without further necessity for inquiries.

An analysis of the functional and performance requirements of this specification and/or site surveys, design, and engineering may lead the Contractor to conclude that additional items are required that are not specifically mentioned in this specification. The Contractor shall be responsible for providing at no added cost to the Employer, all such additional items and services

such that a viable and fully functional communication equipment system is implemented that meets or exceeds the capacity, and performance requirements specified. Such materials and services shall be considered to be within the scope of the contract. To the extent possible, the Bidders shall identify and include all such additional items and services in their proposal.

All equipment provided shall be designed to interface with existing equipment and shall be capable of supporting all present requirements and spare capacity requirement identified in this specification.

The communication equipment shall be designed and provisioned for expansions and reconfigurations without impairing normal operation, including adding and removing circuits. The offered items shall be designed to operate in varying environments. Adequate measures shall be taken to provide protection against rodents, contaminants, pollutants, water & moisture, lightning & short circuit, vibration and electro-magnetic interference etc.

The Bidders are advised to visit sites (at their own expense), prior to the submission of a proposal, and make surveys and assessments as deemed necessary for proposal submission. The successful bidder (Contractor) is required to visit all sites. The site visits after contract award shall include all necessary surveys to allow the contractor to perform the design and implementation functions. The Contractor shall inform their site survey schedule to the Employer well in advance. The site survey schedule shall be finalised in consultation with the Employer. The Employer may be associated with the Contractor during their site survey activities.

After the site survey, the Contractor shall submit to the Employer a survey report on each link and site. This report shall include at least the following items:

- (a) Proposed layout of Equipment in the existing rooms and buildings.
- (b) Proposed routing of power, earthing, signal cables and patch cords etc.
- (c) Confirmation of adequacy of Space and AC/DC Power supply requirements
- (d) Proposals for new rooms/buildings if required
- (e) Identification of facility modifications if required
- (f) Identify all additional items required for integration for each site/location.

1.2.1 Synchronization of the Communication Network

The Contractor shall be responsible for synchronization of new communication equipment with existing network utilizing the existing clock. The Contractor shall make an assessment of additional clock requirement for synchronization of the communication equipment.

1.3 General Responsibilities and Obligations

This section describes the general responsibilities and obligations of the Contractor and the Employer.

1.3.1 Contractor's Responsibilities and Obligations

The Contractor shall be responsible for all cables and wiring associated with the equipment provided, both inside and outside buildings in accordance with technical specifications. The Contractor shall also be responsible for determining the adequacy of the local power source for the equipment and for wiring to it, with adequate circuit protective breakers. In addition, the Contractor shall be responsible for shielding equipment and cabling to eliminate potential interference to or from the equipment, and for earthing all cabinets and shields.

Contractor's obligations include, but are not limited to, the following:

- (1) Site visits, and surveys, necessary to identify and provide all equipment needed to implement the network.
- (2) Equipment Engineering and design specific to each location including review of, and conformance with local environmental and earthing considerations.
- (3) Overall integration of communication equipments/subsystem procured in present with existing User equipments such as SDH, RTUs, SCADA system etc.
- (4) All cabling, wiring including supply, laying and termination etc of the cables, and distribution frame at wideband nodes required for full interconnectivity and proper operation of the telecommunications network including equipment supplied under this package and the connectivity and interfacing of user equipment.
- (5) Installation and integration of network management software, hardware and firmware.
- (6) Project management, project scheduling, including periodic project reports documenting progress, review meeting during the contract period.
- (7) Engineering and technical assistance during the contract and warranty period.
- (8) Implement all minor civil works and identify any major civil works i.e. expansion or construction of rooms, trenches necessary for installation of proposed equipment and provide the details of such work to the Employer.

- (9) Factory and site testing of all hardware, software, and firmware provided.
- (10) Provide documented evidence of satisfactory Type Test performance to the Employer and if required by The Employer, conduct type test.
- (11) Provide a Quality Assurance Plan, ensuring the Employer access to the manufacturing process.
- (12) Training of the Employer personnel.
- (13) Hardware, software, and firmware maintenance, debugging, and support of the equipment through final acceptance, and maintenance on all new equipment through out the warranty period and for a period of six (6) years after warranty period.
- (14) Availability of service, spare and expansion parts for the supplied items for the designed life of the equipment or seven (7) years after the declaration of withdrawal of equipment from production, whichever is earlier. However, the termination of production shall not occur prior to Operational Acceptance of the system by the Employer.

Detailed descriptions of the Contractor's obligations, in relation to individual items and services offered, are delineated in other sections of this specification.

1.4 Applicable Standards

The applicable standards are mentioned in the respective technical section. The offered equipment shall conform to the standards mentioned in the specification except to the extent modified by this specification. In case of any discrepancy between the description given in the specification and the standards, the provisions of the technical specification shall be followed. The parameters not specifically mentioned in this specification shall conform to the standard mentioned in this specification.

Specifications and codes shall be the latest version, inclusive of revisions, which are in force at the date of the contract award. Where new specifications, codes, and revisions are issued during the period of the contract, the Contractor shall attempt to comply with such, provided that no additional expenses are charged to the Employer without Employer's written consent.

In the event the Contractor offers to supply material and/or equipment in compliance to any standard other than Standards listed herein, the Contractor shall include with their proposal, full salient characteristics of the new standard for comparison.

In case values indicated for certain parameters in the specifications are more stringent than those specified by the standards, the specification shall override the standards.

----- **End of this Section** -----

Section 2
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Section 2

Network Configuration and Equipment Characteristics

2.1 Introduction

This section describes the Fibre Optic Communication network configuration and the equipment characteristics for communication system to be installed under the project. The sub-systems addressed within this section are:

- (1) Fibre Optic Transmission System (FOTS)
- (2) Craft Terminal based Network Management System (NMS)
- (3) DDF and Cabling

The requirements described herein are applicable to and in support of network requirements.

The security related requirements of the equipment shall be as per DoT (Department of Telecommunication) guidelines and all similar security requirements as amended by DoT on time to time basis shall be followed/complied by the vendor.

The manufacturer shall allow the Employer and/or its designated agencies to inspect the hardware, software, design, development, manufacturing, facility and supply chain and subject all software to a security /threat check any time during the supplies of equipment

The contractor shall ensure that the supplied equipments have been got tested as per relevant contemporary Indian or International Security Standards e.g. IT and IT related elements against ISO/IEC 15408 standards, for Information Security Management System against ISO 27000 series Standards, Telecom and Telecom related elements against 3GPP security standards, 3GPP2 security standards etc. from any international agency/ labs of the standards e.g. Common Criteria Labs in case of ISO/IEC 15408 standards until 31st March 2013. From 1st April, 2013, the certification shall be got done from authorized and certified agency/lab in India.

The Contractor shall also ensure that the equipment supplied has all the contemporary security related features and features related to communication security as prescribed under relevant security standards. A list of features, equipments, software etc. supplied and implemented in the project shall be given for use by the Employer

The contractor shall get the Employer's equipment audited from security point of view once a year from a network audit and certification agency as identified by DoT. The audit of the equipment shall be carried once in a financial year till the maintenance service contract in the bid.

In case of any deliberate attempt for a security breach at the time of procurement or at a later stage after deployment/installation of the equipment or during maintenance, liability and criminal proceedings can be initiated against the Contractor as per guidelines of DoT

and any other Government department.

2.2 General Network Characteristics

2.2.1 Description

The fibre optic network shall be based on the Synchronous Digital Hierarchy (SDH) having bit rate of STM-4/STM-16 as identified in the BoQ. The network shall consist of overhead fibre optic links with a minimum bit rate of Synchronous Transport Module-4/STM-16 (STM-4/16). The Contractor can propose a system based on higher bit rate systems, if required, so as to meet the link budget requirements or any other specification requirement. The detailed BOQ is described in appendices.

2.2.2 Functional Requirement

The primary function of the communication network is to provide a highly reliable voice and data communication system for grid operation in support of the SCADA/EMS/RTUs/PMUs. The communications support requirement for SCADA/EMS/RTUs/PMUs system is for low & high speed data, express voice circuits and administrative voice circuits as defined in appendices. A brief summary of the communication system requirements is as follows:

- (a) High speed E1 channel support
- (b) Data transport supporting Network Management channels
- (c) The connectivity envisaged between RTUs and Control Centre over TCP-IP using Ethernet interface.

2.2.3 General Systems Requirements

Required characteristics are defined and specified herein at the system level, subsystem level, and equipment level.

2.2.3.1 System Synchronization

The Contractor shall synchronize the existing equipments and all the new equipments under the contract using existing Master clock. The Contractor shall provide the additional clocks as required under the set of clock indicated in BoQ. In addition to GPS input reference, the synchronization clock must have provision to take INPUT reference coming from other clock. The contractor shall submit the synchronisation plan as per standard ITU-T G.811. All sync equipments proposed under this contract should meet ITU-T G.811 criterion. The holdover quality of slave clock, if any, shall meet ITU-T G.812 standard requirements.

The Contractor shall provide system wide synchronization fully distributed throughout the telecom network and connected to all equipments new & existing. The Contractor shall submit the synchronization plan for the entire network meeting the requirement of

ITU-T G.803. The synchronization plan shall clearly indicate the requirement of additional clocks with full justification.

The system equipment requiring “clock” shall be connected to the master clock using external clocking. For this purpose, appropriate interfaces(s) in the transmission & termination equipment being supplied and all other associated hardware shall be provided by the Contractor.

2.2.3.2 System Maintainability

To facilitate performance trending, efficient diagnosis and corrective resolution, the system shall permit in-service diagnostic testing to be executed both locally and from remote locations, manually and/or initiated under NMS control. Such testing shall not affect the functional operation of the system.

2.2.3.3 System Upgradeability and Expandability

Equipment supplied shall be sized (though not necessarily equipped) to support system/subsystem expansion to full capacity as provided by specified aggregate transmission rates. Equipment units provisioned for equipped subunits shall be terminated at appropriate patching facilities or termination blocks. Power supplies and NMS shall be sized for maximum equipped system capacity.

2.2.3.4 Equipment Availability

The calculated availability of each fibre optic link (E1 to E1) shall be at least 99.999%. The calculated availability is defined as the theoretical availability determined by a statistical calculation based on the mean-time-between-failure (MTBF) and the mean-time-to-repair (MTTR) of the components and subsystems comprising the FOTS. For this analysis, an MTTR of at least 4 hours shall be assumed. The down time of the fibre optic cable shall not be considered in the aforesaid availability calculations. The calculated failure rates of the units and the calculated availabilities of the equipment being offered shall be provided by the Contractor during detailed engineering.

2.2.3.5 Revision Levels and Modifications

All hardware, firmware and software delivered as part of the communications network shall be field proven and at the most of current revision level. All modifications and changes necessary to meet this requirement shall be completed prior to the start of the factory tests or under special circumstances, on written approval by Employer, prior to the completion of SAT.

2.2.3.6 Equipment Capacities

Equipment supplied shall be sized and equipped with sufficient capacity to support BoQ and configuration requirements as identified in the appendices. Each subsystem supplied shall be sized (to be equipped as specified) to support full subsystem expansion.

Data communications channelization required to support the NMS subsystems specified in Technical Specifications (TS) are not identified in the appendices. Therefore, the Contractor is required to size and equip the system to include all channelization and channel cards required to support the NMS function.

2.2.3.7 Redundancy Requirements and Protection Schemes

Equipment redundancy and Automatic Protection Schemes (APS) are specified in the Table 2-1. The failure of one element shall not prevent the use of any other that has not failed.

**Table 2-1
Equipment Redundancy Requirements Summary**

<p>Fiber Optic transmission Equipment :</p> <p>SDH equipment</p> <p>Power Supply & Converters -----</p> <p>Common Control* Cards -----</p> <p>* = Common control cards which are essentially required for operation of the equipment.</p>	<p>1:1 APS or distributed power supply</p> <p>1:1 APS</p>
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------

The offered equipment shall support at least SNCP **as per standard ITU-T G.841**. In case the equipment offered by the Bidder does not support the above mentioned minimum protection methods, the bidder shall have to provide all additional equipment needed to provide same level of flexibility, redundancy and functionality at no additional cost to Employer. The bidders shall provide details of protection schemes supported in the Bid document.

The offered equipment shall support automatic switchover function between the redundant modules and all required modules and hardware to support the automatic switch over shall be provided by the Contractor.

2.2.3.8 Lost Signal Recovery

At any digital signal level, reapplication of a lost signal shall result in automatic resynchronization and full restoration to normal operation without manual intervention. All alarms incident to the signal failure, shall be automatically cleared at the equipment, rack and monitoring levels and normal operation indications restored and reported if applicable.

2.2.3.9 Software Upgrades

The Contractor shall provide antivirus software along with all the computer hardware/software which shall be upgraded periodically till the maintenance services contract in the bid. Further, to meet all the specifications requirements during implementation and maintenance, if upgrade in the hardware/software of supplied item is required, the same shall be done by the contractor without any additional cost to the Employer.

2.2.3.10 General Site Considerations

All fiber optic links up to 250 kms transmission line length shall be implemented by the Contractor without repeaters. In order to meet the link budget requirement, the Contractor shall provide all the necessary equipments only in the end stations. The contractor may provide the optical amplifier, wave length translator, optical cards or high capacity SDH equipment with suitable rack/subrack to meet the maximum distance limit. All the provided equipments shall be monitored by centralized NMS.

2.2.3.11 Proposed Optical Fibre Characteristics

The link budget calculations and equipment design shall be based on the specified fibre parameters. The optical cables shall have Dual Window Single Mode (DWSM) fibres conforming to ITU-T Recommendations G.652D and the major parameters of these optical fibre(s) are defined in Table-2-2:

Table-2-2 Optical Fibre Characteristics	
Fibre Description:	Dual-Window Single-Mode (DWSM)
Mode Field Diameter:	8.6 to 9.5 μm ($\pm 0.6 \mu\text{m}$)
Cladding Diameter:	125.0 $\mu\text{m} \pm 1 \mu\text{m}$
Mode field Concentricity Error:	$\leq 0.6 \mu\text{m}$
Core-Clad concentricity error:	$\leq 1.0 \mu\text{m}$
Cladding non-circularity	$\leq 1\%$
Cable Cut off Wavelength:	$\leq 1260 \text{ nm}$
1550 loss performance	As per G.652D
Proof Test Level	$\geq 0.69 \text{ Gpa}$
Attenuation coefficient	@1310nm $\leq 0.35 \text{ dB/Km}$ @1550nm $\leq 0.21 \text{ dB/Km}$
Attenuation variation with Wavelength 1285 nm - 1330 nm 1525 nm – 1575 nm	Attenuation coefficient @1310 $\pm 0.05 \text{ dB}$ Attenuation coefficient @1550 $\pm 0.05 \text{ dB}$
Point discontinuities	$\leq 0.1 \text{ dB}$

Table-2-2 Optical Fibre Characteristics	
Chromatic Dispersion; Max.:	18.0 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) @ 1288-1339nm 5.3 ps/(nm x km) @ 1271-1360nm
Zero Dispersion Wavelength: Zero Dispersion Slope:	1300 to 1324nm 0.092 ps/(nm ² xkm) maximum
Polarization mode dispersion coefficient	$\leq 0.2 \text{ ps/km}^{1/2}$
Temperature Dependence:	Induced attenuation $\leq 0.05 \text{ dB}$ (-60 deg C - +85 deg C)
Bend performance:	@1310nm (75 \pm 2 mm dia Mandrel), 100 turns; Attenuation rise $\leq 0.05 \text{ dB}$ @1550nm (30 \pm 1 mm dia Mandrel), 100 turns; Attenuation rise $\leq 0.10 \text{ dB}$ @1550nm (32 \pm 0.5 mm dia Mandrel), 1 turn; Attenuation rise $\leq 0.50 \text{ dB}$

2.2.5 Fibre Optic Link Lengths

The fiber optic route lengths are as specified in appendices. The lengths specified in appendices are the transmission line route lengths; however the actual fiber cable length shall exceed the route lengths on account of extra cable requirement due to sag, jointing & splicing, approach cabling etc. For bidding purposes the Contractor may assume an additional cable length of 5% of given route length + 1Km towards approach cable for calculating the link length. The exact cable lengths shall be determined by the Contractor during the survey. The same shall be used by the Contractor for final link design during the detailed engineering of the project.

2.3 Fibre Optic Transmission System

The Fibre Optic Transmission System (FOTS) is defined herein to include ETSI digital optical line termination equipment. The FOTS shall be based on SDH technology. Minimum aggregate bit rate shall be STM-4/STM-16 and equipped with 2 nos. of minimum 16 port E1 interface(G.703) card, one no. of minimum 4 port Ethernet interface (IEEE 802.3/IEEE 802.3u) card supporting layer 2 switching as tributaries. The Ethernet interfaces shall support VLAN (IEEE 802.1P/Q), spanning tree (IEEE 802.1D) quality of service. Protection scheme for Ethernet traffic should be ERPS based (Ethernet ring protection scheme) as per ITU-T G.8032.

The Contractor shall provide (supply and install) connectorised jumpers (patch cords) for FODP-to-equipment and equipment-to-equipment connection. Two number spare jumpers shall be provided for each equipment connection. Fiber jumpers shall be of sufficient lengths as to provide at least 0.5m of service loop when connected for their intended purpose.

2.3.1 SDH Equipment

2.3.1.1 Functional Requirement

There is a requirement for different types of equipment under this project which are described in this section. The BOQ is provided in the appendices. For the purpose of BOQ, the SDH Equipment is considered to be divided in three parts i.e. Optical interface/SFP, Tributary Cards (Electrical tributaries such as E1 & Ethernet 10/100 Mbps) and Base Equipment (Consisting of Common Cards, Control Cards, Optical base card, Power supply cards, sub-rack, cabinet, other hardware and accessories required for installation of equipment i.e. everything besides optical interface/SFP and tributary cards).

If bidder is offering equipment with multifunction cards such as cross-connect or control card with optical interface/SFP or tributary interface, such type of multifunction card shall be considered as Common control card and shall be the part of base equipment. In case optical interface/SFP is embedded with control card, the adequate number of optical interface/SFPs shall be offered to meet the redundancy requirements of the specifications. Further, control card shall not be equipped with more than one optical interface/SFP and optical base card shall not be equipped with more than two optical interface/SFPs.

The equipment shall be configurable either as Terminal Multiplexer (TM) as well as ADM with software settings only.

SDH ADM

The aggregate interfaces shall be (at least) STM-4/STM-16 towards at least two protected directions (Protected as specified in this specifications). At present the equipment shall be equipped with a 2 nos., min.16 E-1 port electrical tributary cards & one no., min.4 port Ethernet interface card as tributaries. The equipment shall provide access to full STM-4 payload.

The offered STM-4 SDH equipment shall be upgradeable to STM-16 by changing optical line cards only. Cross connection (VC4) capability of offered SDH equipment shall be provided according to STM-16 equipment. The contractor shall demonstrate the STM-16 upgradeability during FAT.

2.3.1.2 Redundancy and Protection

Two fibre rings shall be implemented wherever the network permits. On linear sections of

the network, protected links using 4 fibres shall be implemented.

2.3.1.3 Service Channel

Service channels shall be provided as a function of the SDH equipment and shall be equipped with Service Channel Muldem's that shall provide at a minimum: One voice channel (order wire) with analog interface (0.3 to 3.4 kHz) and one data channel. Both omnibus and selective calling facilities shall be provided. There shall be a facility to extend the line system order-wire to any other system or exchange lines on 2W/4W basis.

2.3.1.4 Supervision and Alarms

ISM (In Service Monitoring) circuitry shall be provided as a function of the SDH equipment. Local visual alarm indicators shall be provided on the equipment, as a rack summary alarm panel. Alarms shall be as per ITU-T Standards G.774, G.783 and G.784. Additionally, F2/Q2 interfaces for a local craftsperson terminal interface and remote equipment monitoring is required.

The Equipment shall support collection of at least four (4) external alarms for monitoring and control of station associated devices by the NMS.

2.3.1.5 Synchronisation

The equipment shall provide synchronisation as per Table 2-2. One 2MHz synchronisation output from each equipment shall be provided.

2.3.1.6 Electrical and Optical I/O Characteristics and General Parameters

Table 2-3 provides the electrical and optical characteristics as well as other general parameters for SDH equipment.

Table 2-3 Electrical and Optical I/O Characteristics and General Parameters	
Optical Wavelength ^{NOTE (1)}	1310/1550nm
Optical Source ^{NOTE (2)}	Laser
Optical Source Lifespan	Better than 5 X10 ⁵ hours
Optical Fibre Type	G.652 D
Optical Connectors	Type FC-PC
Transmission Quality	Per ITU-T G.821, G.823, G.826
Source Primary Power	-48 Vdc
Equipment Specifications	Per ITU-T G.783
Tributary, Electrical Interface	Per ITU-T G.703, 75 Ω
Ethernet Interface	10/100 Mbps
SDH Bit Rates	Per ITU-T G.703

Optical Interfaces	Per ITU-T G.957, G.958
Frame and Multiplexing Structure for SDH	Per ITU-T G.707
Synchronization	Per ITU-T G.813
Management Functions	Per ITU-T G.774, G.784
Protection Architectures	Per ITU-T G.841
Built In Testing and Alarms	Per ITU-T G.774, G.783, G.784

NOTE (1) Optical wavelength shall be selected considering the characteristics of the optical fibre and the link budget.

NOTE (2) **Eye Safety for Laser Equipment:** To avoid eye damage, when a receiver detects a line interruption, it is required that the optical power of the laser shall be reduced to safe limits on the transmitter in the opposite direction as per ITU-T G.958.

NOTE (3) In case other than FC-PC connector is provided in the equipment, suitable patch cord with matching connector are to be provided to connect with FODP.

2.3.2 Optical Link Performance Requirements

The optical fibre link performance requirements are specified as follows:

2.3.2.1 Link Budget Calculations

The fibre optic link budget calculations shall be calculated based upon the following criteria:

(1) Fibre attenuation: The fibre attenuation shall be taken to be the guaranteed maximum fibre attenuation i.e. 0.21 dB/Km @1550nm and 0.35 dB/km @1310nm.

(2) Splice loss: Minimum 0.05 dB per splice. One splice shall be considered for every 3 kms.

(3) Connector losses: Losses due to connectors shall be considered to be minimum 1.0 dB per link.

(4) Equipment Parameters: The equipment parameters to be considered for link budget calculations shall be the guaranteed “End of Life (EOL)” parameters. In case, the End of Life parameters are not specified for the SDH equipment, an End of Life Margin of at least 2 dB shall be considered and a similar margin shall be considered for optical amplifiers.

(5) Optical path Penalty: An optical path penalty of at least 1 dB shall be considered to account for total degradations due to reflections, inter symbol interference, mode partition noise and laser chirp.

(6) Maintenance Margin: A maintenance margin of at least 2.5 dB/100Km shall be kept towards cabling, repair splicing, cable ageing and temperature variations etc.

(7) Other losses: Other losses, if any required specifically for system to be supplied shall also be suitably considered.

(8) Dispersion: The fibre dispersion shall be taken to be the guaranteed maximum dispersion i.e. 18 ps/nm.Km @1550 nm & 3.5 ps/nm.km @ 1310 nm for DWSM fibres.

(9) Bit Error Rate: The link budget calculations shall be done for a BER of 10^{-10} .

The bidders shall determine the total link loss based on the above parameters and shall submit the system design (including link budget calculations) for each category of fibre optic link during detailed engineering.

For finalising the FOTS system design & BOQ, above methodology shall be adopted taking into account fibre attenuation, dispersion and splice loss determined during the detailed engineering. Accordingly, additions and deletions from the contract shall be carried out based on unit rates indicated in the contract.

2.3.2.2 Link Performance

The Link performance for ES, SES and BER for the fibre optic links shall correspond to National Network as defined in ITU-T G.826.

2.3.2.3 FODP to SDH Equipment

The Contractor shall be responsible for connectivity between the FODP and the SDH equipment. The Contractor shall provide FC PC coupled patch cords. The patch-cord length between the FODP & equipment rack shall be suitably protected from rodents, abrasion, crush or mechanical damage.

2.4 DDF and Cabling

For the purposes of the specification, the contractor shall provide cabling, wiring, DDF patching facilities to the wideband telecommunications system. Equipment and material components for DDF and cabling are also part of this procurement. It shall be the Contractor's responsibility to provide all cable support required for full supplied equipment interconnection and shall be in accordance with communications industry standard practices and the requirements mentioned in the technical specifications.

2.5.1 Digital Distribution Frame Functional Requirements

The Contractor shall provide DDF for Digital Signal Cross connect (DSX) Broadband-quality (better than 20 MHz) patching facilities configured "normally-thru" with Equipment, Line and Monitor Patch Jacks. DDFs shall provide the following basic functions:

- (i) "Normally thru" circuit routing
- (ii) Circuit rerouting via patch cord assemblies
- (iii) Circuit disconnect and termination

All DDFs shall be sized and equipped to support the offered configuration of the provided equipment. Independent Transmit and Receive patch jack assemblies (line and equipment) shall provide for separate transmit and receive single-plug patching. Transmit and receive patch jack assemblies shall be located side-by-side such that dual-plug patch cord assemblies may be used to route both transmit and receive for the same circuit.

2.5 Patch Cords

The Contractor has to supply FC PC coupled Patch cords as described in BOQ. The Patch cord return loss shall be equal to or better than 40 dB and insertion loss equal to or less than 0.5 dB.

2.6 Telecommunication Management Network / Network Management System

The Contractor shall provide Craft Terminal based Telecommunications Management Network System (NMS) for operational support to the FOTS subsystems. This NMS shall provide the capability to monitor, reconfigure, and control elements of the telecommunications network with the help of a portable personal computer to be known as craft terminal. The Contractor shall submit for Employer's approval the NMS architecture describing in detail the following subsystems/features:

- (a) Database used in NMS
- (b) Peripherals and hardware
- (c) Software and operating system
- (d) Craft Terminals

2.7.1 Management Functions

The NMS shall support following Management functions:

2.7.1.1 Configuration Management

Configuration management is concerned with management, display, and control of the network configuration. Minimum specific requirements that shall be satisfied include the following:

- a. Provide tools to establish and maintain the backbone topology and configuration information and provide graphical maps depicting the configurations.
- b. Gather descriptive information about the current configuration of the equipment, provide operator displays, and prepare reports.
- c. Provide tools for planning, establishing, and changing the static equipment configuration. Provide for changes to the equipment configuration in response to equipment failures, planned upgrades, and operator requests to take equipment offline for testing.
- d. Provide verification testing to support new equipment installation.

2.7.1.2 Fault Management

Fault management is concerned with detecting, diagnosing, bypassing, directing service restoration, and reporting on all the backbone network equipment, systems, and links. Minimum specific requirements that shall be satisfied include the following:

- a. Display equipment status in a consistent fashion regardless of the source of the data on a graphical topological, map-type display. Status shall be displayed through the use of colours on links and nodes as well as through text.
- b. Obtain status and detect faults through periodic polling, processing of unsolicited alarms and error events, and periodic testing for connectivity.
- c. Maintain an alarm summary of unacknowledged alarm events on the management station display and maintain a log of all received alarms. The operator shall be able to acknowledge and clear alarms individually and as a group. The use of alarm correlation techniques is encouraged to minimize the proliferation of alarms caused by a single, common event. All alarms shall be configurable as critical alarms, major alarms and minor alarms with different colours.
- d. Provide the capability to diagnose and isolate failures through analysis of error and event reports and through the use of both on-line and off-line diagnostic tests and display of monitored data.
- e. The criteria for fail over shall be configurable as automatic fail over to redundant equipment wherever possible and through operator-initiated actions where automatic fail over is not possible. The status of fail over shall be reported to the NMS.
- f. Track network equipment failure history.

2.7.1.3 Performance Management

Performance management is concerned with evaluation of the use of network equipments and their capability to meet performance objectives. Minimum specific requirements that shall be satisfied include the following:

- a. Provide support for an operator to initiate, collect, and terminate performance metrics under both normal and degraded conditions. For example, BER of each link, together with other data measured at each node, shall be available on operator request.
- b. Monitor point to point & end to end signal quality and history. Provide operator controls to monitor performance of specified events, measures, and resources. Specifically provide displays to permit the operator to:
 - 1. Select/deselect network equipments, events, and threshold parameters to monitor
 - 2. Set monitoring start time and duration or end time

3. Set monitoring sampling frequency
4. Set/change threshold values on selected performance parameters
5. Generate alarm events when thresholds are exceeded.
6. Set multiple thresholds on certain performance parameters. Alarm categories include as a minimum a warning and a failure.
7. Calculate selected statistical data to measure performance on selected equipment based on both current and historical performance data maintained in performance logs. Performance data provided is limited to what is available from the equipment Contractors.
8. Provide graphical displays of point to point and end to end current performance parameter values. Provide tabular displays of current, peak, and average values for performance parameters.
9. Generate reports on a daily, weekly, monthly, and yearly basis containing system statistics.

2.7.1.4 Security Management

The NMS shall be provided with security features to limit access to monitoring and control capabilities to only authorized personnel. One access level of System Administrator and at least two levels of operator access shall be provided - read (view) only, and write (configure). The system administrator shall be able to create, define and modify operators with different access levels, network domains and perform all kind of maintenance and up gradation of the NMS system. With "read only" access level, network parameters should only be viewed. Access to database maintenance, command control and test functions shall be available with "write " access level. Means shall be provided to ensure only one authorized user has write capability for a selected domain of the network. It shall be possible to define multiple domains for purposes of monitoring and control.

Human error and conflict detection are also required. Such errors and access violations shall be reported to the offending user as error messages and warnings.

2.7 Communication Channel Requirement and Integration

Communication requirements for NMS system have not been considered in Appendices and the Contractor shall provide these as a part of NMS system. The Contractor shall provide all required interface cards / devices etc. The NMS data transport shall utilize the wideband communications transmission system service channel in the overhead whenever possible.

2.8 Craft Terminal

Each equipment on the fibre optic communication network shall include provision for connecting a portable personal computer (PC) to be known as craft terminal to support local commissioning and maintenance activities. Through the use of this PC and local displays/controls, the operator shall be able to:

- a. Change the configuration of the station & the connected NEs.
- b. Perform tests
- c. Get detailed fault information

The craft terminal shall be connected to the interface available in the communication equipment. Portable (laptop) computers (Craft terminals), each complete with necessary system and application software to support the functions listed above, shall be supplied to the employer as per BOQ given in the appendices.

2.9 Hardware Requirements

2.10.1 Craft Terminal

The craft terminal shall have suitable processor(s) which shall be sufficient to meet all the functional requirement and expansion capabilities stipulated in this specification. Only reputed make like Dell, IBM, HP, Compaq make shall be supplied.

The Craft Terminal shall be a laptop. The craft terminal shall have minimum configuration of 2.4 GHz, 2 GB RAM, 256 MB Video Graphics Memory, DVD RW drive, 160 GB Hard Disk Drive, keyboard, mouse/trackball etc., parallel, serial/USB (2.0) ports to accommodate printers, and Internal/external Data/Fax modem and a battery back-up of at least 60 minutes. VDUs shall be 15" TFT active matrix color LCD with a minimum resolution of 1024 X 768.

2.10.2 Power Supplies

The NMS system shall use 220 volts 50 Hz A.C or -48 volt D.C as available at site for its operation as available at site.

2.10 General Software/Firmware Requirements

Due to various alternative design approaches, it is neither intended nor possible to specify all software and firmware characteristics. It is the intent herein to provide design boundaries and guidelines that help to ensure a demonstrated, integrated program package that is maintainable and meets both hardware systems requirements and the customer's operational requirements.

2.11.1 Operating System Software

Operating system software shall be provided to control the execution of system programs, application programs, management devices, to allocate system resources, and manage communications among the system processors. The contractor shall make no modifications to the OEM's operating system, except as provided as USER installation parameters.

2.11.2 Applications Software

All applications software shall be written in a high-level programming language unless developed using industry proven application programs and development tools provided with the system. The

contractor shall make no modifications to the applications program except as provided as USER development tools.

2.11.3 Software Utilities

A utility shall be provided to convert all reports into standard PC application formats such as excel.

2.11.4 Revisions, Upgrades, Maintainability

All firmware and software delivered under this specification shall be the latest field proven version available at the time of contract approval. Installed demonstration for acceptance shall be required. All firmware provided shall support its fully equipped intended functional requirements without additional rewrite or programming.

All software shall be easily user expandable to accommodate the anticipated system growth, as defined in this specification. Reassembly recompilation or revision upgrades of the software or components of the software, shall not be necessary to accommodate full system expansion.

Software provided shall be compliant with national and international industry standards.

2.11.5 Database(s)

The contractor shall develop all the databases for final wideband network following the global acronyms for all stations. Database(s) to be provided shall contain all structure definitions and data for the integrated functional requirements of NMS system.

NMS operator Groups shall share the same virtual database. This means that they shall share the same database and database manager, whether or not physically separate databases are maintained.

2.11.6 Help

All applications shall be supported by USER accessible HELP commands that shall assist the user in the performance of its tasks. HELP commands for an application shall be available to the user from within the active application and shall not interfere with the activities of the application.

-----End of the Section-----

Section – 3
Environment, EMI, Power Supply, Cabling and Earthing

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Section - 3

Environment, EMI, Power Supply, Cabling and Earthing

The purpose of this section is to describe the minimum general equipment characteristics and specifications for environmental conditions, source power conditioning and backup, equipment construction, and installation. The section also highlights the stringent Electro Magnetic Compatibility (EMC) guidelines for equipment that will be operated under the severest Electro Magnetic Interference (EMI) and Electro Static Discharge (ESD) conditions expected in an Extra High Voltage (EHV) power system environment.

3.1 Environmental Requirements

Equipment and their components provided under this specification shall operate reliably under the following environmental conditions.

3.1.1 Temperature and Humidity

Most of the equipment will not be installed in environmentally controlled shelters. Therefore, equipment shall operate in accordance with the limits shown in Table 4-1.

Table 4-1
Environmental Operating Limits

Temperature Range: Specification Operation without damage Shipping/storage	(Un Controlled Environment) 0 to 45°C -10 to 55°C -40 to 60°C
Relative Humidity, non-condensing	Upto 90%
Elevation: Operating Non-operating	 to 3,000 m to 10,000 m

For each location, the Contractor is required to assess the environmental conditions for the equipment to be installed under this specification. The Contractor is responsible for all necessary enclosure, rack or equipment upgrades to ensure the proper operation of the installed equipment.

3.1.2 EMI and Electrostatic Interference

At each location, the Contractor shall assess the need for shielding against radiated emissions and shall provide recommended solutions for any EMI problem found at each location. Specifications provides the type of immunity tests for which the equipment shall be required to

pass without failure. For the individual tests to be carried out at the different interfaces, references are made to the relevant IEC and ITU-T recommendations.

3.1.3 Vibration and Shock Resistance

As per testing requirements indicated in this specification.

3.1.4 Tropicalization

Communications equipment will often be stored and operated in uncontrolled environment areas and will be subject to mould, growth of fungus, corrosion and oxidation. The equipment and components shall be suitably tropicalized during manufacture through commissioning, as necessary.

3.1.5 Contaminants

Communications equipment may be located in areas of poor air quality with the main contaminant being dust. Cabinets shall be tight fitting utilizing filtered ventilation openings only.

3.2 Primary Source AC/DC Power Requirements

Facilities will be required to support both AC and DC power load requirements of telecommunications equipment as specified below:

3.2.1 Primary Source AC Power

It will be the Employer's responsibility to provide required Primary AC source Power for communications equipment installed under this specification. The Primary AC Power supplied will be 240 VAC \pm 10%, 50Hz with a frequency variance between 46 and 55 Hz. Harmonic distortion will not exceed five (5) percent.

All equipment and components provided under this specification requiring Primary AC Power, shall be designed for normal operation under the above stated tolerances for 240 VAC supply.

The Contractor shall provide in their Bid as well as in the survey report to the Employer the projected 240 VAC Primary Power load requirement per equipment and totals, by location, for equipment provided under this specification. The Contractor shall provide suitable UPS for communication equipment/module etc. requiring AC power supply at locations other than control centre.

3.2.2 -48V DC Power

Power supplies/converters for communications equipment (except computer system supplied as part of NMS which shall use 240 VAC) provided under this specification, shall use -48Vdc uninterrupted primary source power. The power supply may vary normally within the voltage range -42 to -58 Vdc and the supplied equipment shall operate satisfactorily within this range.

3.2.3 Power Distribution and Protection

The Employer will furnish only one source primary 240 VAC and/or -48 VDC power. It shall be the Contractor's responsibility for the connection and distribution of all Primary AC and -48V dc source power, in full compliance with all local and national electrical codes.

The Employer shall indicate during the survey by Contractor, on the primary source, the feeders/points that can be used by the Contractor. The Contractor shall supply & install Primary AC and -48Vdc feeder cables to Contractor-furnished distribution panels.

The Contractor shall provide required distribution panels, circuit breakers and appropriate Panel Disconnects. Distribution Panel feeders, Panel Disconnects, distribution panels and circuit breakers shall be sized and equipped to support at least 100% expanded load requirements.

The Contractor shall provide and install all required primary power distribution sourced from the distribution panels. The Contractor shall also be responsible for Load Balancing.

The Contractor is responsible for all inter-rack (enclosure) and intra-rack (enclosure) power distribution required to support equipment supplied under this specification. The Contractor shall provide all cabling, fusing, switching and circuit breaker and surge protection required.

Partially equipped subsystems shall be installed with provision for expansion. Equipment power supplies provided under this specification, shall be sized to support fully equipped subsystems. Primary power distribution protection shall be sized to support and protect maximum operating load potential whether or not the actual projected load shall meet that maximum load potential.

The Contractor shall provide equipment and rack safety earthing in compliance with this specification.

3.3 Equipment Construction, Assembly and Installation

All equipment supplied under this specification shall be constructed, assembled and installed in accordance with the following requirements:

3.3.1 Identification

All cabling, racks/enclosures, equipment, modules and materials shall be uniquely identifiable as per the following:

3.3.1.1 Equipment

Each equipment component to the level of printed circuit card, shall be clearly marked with the manufacturer's part number, serial number, month/year of manufacture and revision level. Changes to components shall be identified by an unambiguous change to the marked revision level. The Contractor shall be responsible for maintaining the master revision level list until the Contractor has complied with all requirements of this specification.

Where custom components and parts are provided, each component/part shall be marked to specifically identify that component/part. Printed circuit card cages are defined as an equipment component and as such, shall be clearly identified as stated within this specification.

Equipment chassis and printed circuit card cages having wired backplanes, shall be clearly marked with the manufacturer's part number, serial number, month/year of manufacture, revision level and an additional identifier corresponding directly to the applicable backplane wiring diagram/list.

3.3.1.2 Power Distribution

Power distribution panels shall be clearly marked with their unique identifier, source feed information, and remote source feed emergency disconnect location and identity.

Power distribution panel "Main Disconnect" and circuit breakers shall be clearly marked with a unique identifier. Circuit breaker feed lists shall be clear, accurate and the feed list information shall be posted inside each distribution panel door.

Inter-rack and intra-rack (enclosure) power distribution shall be clearly identified with source feed, voltage and power rating information. All power feed cabling shall be clearly identified near the point of termination.

All power distribution identification shall utilize heat-resistant permanent marking techniques such as stamped non-metallic tags, embossed labels, etc. Marking techniques are subject to approval by the Employer. Power distribution identifiers and information shall agree with the Contractor's power cable plant drawings.

3.3.1.3 Signal Cabling

Connectorised signal cabling/wiring requires marking with a unique identifier at each connectorised end. The signal cable/wire identifier shall include a cable identifier and the location of both terminations.

Signal cable/wiring installed on terminal blocks requires marking with the cable identifier and distant end location. The cable tag shall be clearly visible at the cable fanout point.

All signal cable, wiring and terminations shall be clearly labelled/tagged with identifiers consistent with Contractor supplied cable plant records. Marking techniques are subject to approval by the Employer.

3.3.1.4 Equipment Racks and Enclosures

All equipment racks, enclosures and equipment, including distribution frames, shall be clearly labelled with unique identifiers consistent with Contractor supplied floor plans and rack elevations.

3.3.2 Installation Hardware

Equipment racks, enclosures, cable raceways and installation hardware shall, at a minimum, comply with the following requirements:

3.3.2.1 Equipment Sub-Racks and Cabinets (Enclosures)

All equipment provided under this specification, shall be physically mounted in sub-racks and cabinets (enclosures). The Contractor shall determine and propose for the Employer approval, the type, size, weight and manner of installation for each location.

Selection of equipment sub-racks and cabinets (enclosures) shall meet the following requirements:

(A) Equipment SubRack Construction

Equipment Sub Racks provided for installation in environmentally controlled facilities, shall meet the following minimum requirements:

- (1) Equipment Sub Racks shall be steel/aluminium fabricated and finished on all surfaces. All metal and welds shall be thoroughly cleaned and sanded to obtain a smooth finish. All surfaces shall be treated for rust and primed to form a bond between metal and the finish coats of paint.
- (2) Equipment covers shall be provided for exposed components mounted in equipment sub Racks.
- (3) Dust and moisture protection shall meet or exceed IP20 standards.

(B) Equipment Cabinet (Enclosure) Construction

- (1) Equipment cabinets (enclosures) shall be steel/ steel & Aluminium extrusion fabricated and finished on all surfaces. All metal and welds shall be thoroughly cleaned and sanded to obtain a smooth finish. All surfaces shall be treated for rust and primed to form a bond between metal and the finish coats of paint.
- (2) Equipment cabinets (enclosures) shall be designed free-standing but shall be mounted to the floor. Cabinets (enclosures) shall have secure fitting, lockable, full-length front doors for access to hardware and wiring. Equipment covers for exposed components mounted inside cabinets are not required unless specifically recommended.
- (3) All doors and removable panels shall be fitted with long life rubber beading. All panels shall be fabricated from minimum 2.0mm thickness steel sheet. However, for racks with load bearing Aluminium extrusion frame, door panels and side panels may be fabricated from minimum 1.6mm thickness steel sheet and the top & bottom panels shall be fabricated from minimum 2.0mm thickness steel sheet.

- (4) Equipment cabinets (enclosures) shall be dust and moisture-proof as per IP41 specification, or better.

3.3.2.2 Cable Raceways

The Contractor is required to provide and install all additional necessary indoor and outdoor cable raceways. The cable raceways shall be in conformance with the following:

- (1) Signal cabling and power cabling shall require separate cable raceways. Signal and power cabling shall not share the same raceways and shall be installed as far apart as is practical. Adequate shielding shall be provided as required.
- (2) All cable raceways shall be sized to support full loading requirements plus at least a 200% safety loading factor.
- (3) Outdoor cable raceways shall be of corrugated construction and shall be fitted with solid covers overlapping all sides of the cable raceways.
- (4) Outdoor cable raceways shall be fabricated from construction grade aluminum, galvanized iron or anodized sheet metal or any other suitable material approved by the Employer. Suitable anti-corrosion measures shall be taken. Steel fabricated raceways shall be finished inside and out, treated to resist rust and to form a metal-to-paint bond.
- (5) Indoor cable raceways fabricated of aluminum or galvanized iron, shall not normally need special finishing or painting, unless otherwise stipulated by the Employer. Steel fabricated raceways shall require a red oxide primer coat at a minimum.

3.3.3 Signaling Distribution

The Contractor shall be responsible for all signal wiring associated with furnished equipment in accordance with the following:

- (1) All signal wiring connections to the communications equipment shall be via Krone type or equivalent terminal blocks.
- (2) The Contractor shall provide subscriber level wiring and patching wherever required.

3.3.4 Lightning and Transient Voltage Protection

The Contractor shall be required to provide protection from lightning and transient voltages for all wideband communications equipment, in accordance with the following:

- (1) At the outside cable plant point-of-entry of all cabling penetrations for all cabling

installed by the Contractor, the Contractor shall provide lightning and transient voltage isolation for the inside plants cabling, wiring, and all terminations and equipment.

- (2) All equipment installed under this specification that requires 240VAC primary power, shall be surge protected.

3.3.5 Station Safety Earthing and Signal Grounding

For each facility, the Contractor is responsible for meeting the following station and equipment earthing requirements:

- (1) All safety earthing and signal grounding shall be in full compliance with EMI/EMC requirements as per relevant international standards
- (2) Each cabinet (enclosure) or cabinet (enclosure) group shall include suitable signal ground and safety earth networks. The signal ground network shall terminate at a separate signal ground stud connection isolated from safety earth.
- (3) Each earth/ground network shall utilize copper bus bars, copper braids and/or 16 sqmm or bigger earth cable. All equipment earth/ground connections shall be made directly to the equipment chassis utilizing grounding lugs and secured metal-to-metal with star washers. Use of the enclosure frame, skin or chassis mounting hardware as part of the earthing/grounding networks, is not acceptable.
- (4) The safety earth network shall be connected to "earth ground" at the safety earth stud. The earth stud connection shall be sized for an external earthing cable equipped with a 2/0 solid copper lug secured metal-to-metal with star washers. Primary AC feeds and distribution within enclosures requires earthing wire connection to the safety earth stud.
- (5) The safety earth and signal ground networks shall be inter-connected only at the safety earth stud and signal ground stud.

The Contractor shall extend the existing station earth to the equipment room using suitable G.I. earthing strip (50 x 6 mm), wherever required. .

The Contractor is responsible for providing all required earthing/grounding cable and installation. Cabinet (Enclosure) and equipment safety earthing and signal grounding shall be subject to the Employer's approval.

The Contractor shall be responsible for determining the suitability of existing station earth for the equipment to be supplied under this contract. In case existing earthing arrangement at the site is not adequate, the Contractor shall either make improvement in the existing earthing arrangement or make new earthing as per requirement.

3.3.6 Interconnections

All power and signal cabling between component units of the communications systems shall be supplied and installed by the Contractor and shall be shown on contractor-supplied as-built drawings.

The Contractor shall supply and install all primary power cords, powerstrips, receptacles, circuit breakers, fuse panels, switches, earth fault detectors, surge protectors, distribution cabling, and power connectors required to support all equipment enclosures and system components furnished and installed under this specification, except as specifically excluded.

Plug-type power connectors with captive fastening (such as "Twist-Lock") shall be used for interconnection of source power to the equipment enclosures or racks.

Plug-type connectors with captive fasteners (ie. DB-25, etc) shall be used for the interconnection of all inter and intra-enclosure signalling cable.

3.3.7 Finish Colors

Unless otherwise specified, finish colors for enclosures shall be gloss white enamel on the inside, and semi-gloss medium grey enamel on the outside. Only brushed aluminum trim shall be used. Employer reserves the right to approve the proposed color scheme.

3.4 Location of Equipment, Cable Routes and Associated Civil Works

During the Site Surveys, the Contractor shall determine and propose locations for all equipment to be supplied under this contract. Further, the Contractor shall locate and identify proposed routing for all cabling between all equipment locations including existing and planned equipment not provided under this contract, but required to be connected under the scope of this contract. This subsection defines the requirements and clarifies the responsibilities of the Employer and the Contractor regarding equipment siting, intra and inter facility interconnectivity and necessary associated civil works.

3.4.1 Locations for Supplied Equipment

All transmission equipment and associated DDFs, shall generally be co-located in the same communications room located in the Control Building whenever possible.

3.4.2 Associated Civil Works

The Contractor shall provide all required minor civil works necessary for full connectivity as required in the Contractor's scope of work as follows:

- (1) All wall and floor penetrations necessary for the installation of all cabling to be performed in accordance with the requirements of this specification.
- (2) Installation of racks, cabinets, cable raceways, and cabling supplied as part of this

contract.

3.4.3 Cable Trenches

A network of cable trenches and/or ducts may exist at some sites but shall require expansion and/or new construction at some stations. It shall be a responsibility of the contractor to cooperate fully with the Employer and all other on-going project contractors in the planning and efficient use of existing and new cable trenches. The existing cable trenches/ cable raceways proposed to be used shall be identified in the survey report. The contractor shall make its best effort to route the cable through the existing available cable trenches. Where suitable existing cable trenches are not available, suitable alternatives shall be proposed for Employer approval. The Employer shall provide any additional cable trenches required for such approved alternatives.

It may be noted that in order to utilise the existing trenches, the Contractor supplied cables may be required to be co-located with LV cables. Accordingly, the contractor shall ensure that selection and installation of cables is suitable for the purpose. The contractor shall be responsible for new building penetrations required for supplied cabling. Caution shall be taken to ensure existing equipment and site personnel are protected from dust and debris incident to the cable penetration work. Penetration shall be neatly formed and sealed for protection from moisture, dust wind and vermin intrusion.

All required fitting, supports, accessories, ducts, inner ducts, conduits, riser and any item not specially mentioned but required for lay and installation of cables in trenches shall be supplied and installed by the Contractor.

-----**End of this Section**-----

Section - 04

Inspection, Test and Availability

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Section - 04

Inspection, Test and Availability

All materials furnished and all work performed under this Contract shall be inspected and tested. Deliverables shall not be shipped until all required inspections and tests have been completed, and all deficiencies have been corrected to comply with this Specification and approved for shipment by the Employer.

Except where otherwise specified, the Contractor shall provide all manpower and materials for tests, including testing facilities, logistics, power and instrumentation, and replacement of damaged parts. The costs shall be borne by the Contractor and shall be deemed to be included in the contract price.

The entire cost of testing for factory & site acceptance, routine tests, production tests and other test during manufacture & site activities specified herein shall be treated as included in the quoted unit price of materials, except for the expenses of Inspector/Employer's representative.

Acceptance or waiver of tests shall not relieve the Contractor from the responsibility to furnish material in accordance with the specifications.

All tests shall be witnessed by the Employer and/or its authorized representative (hereinafter referred to as the Employer) unless the Employer authorizes testing to proceed without witness. The Employer representative shall sign the test form indicating approval of successful tests.

Should any inspections or tests indicate that specific item does not meet Specification requirements, the appropriate items shall be replaced, upgraded, or added by the Contractor as necessary to correct the noted deficiencies at no cost to the Employer. After correction of a deficiency, all necessary retests shall be performed to verify the effectiveness of the corrective action.

The Employer reserves the right to require the Contractor to perform, at the Employer's expense, any other reasonable test(s) at the Contractor's premises, on site, or elsewhere in addition to the specified Type, Acceptance, Routine, or Manufacturing tests to assure the Employer of specification compliance.

All security related features shall be demonstrated during FAT/SAT as required by the Employer.

4.1 Inspection

Access to the Contractor's facilities during system manufacturing and testing and to any facility where systems/ equipment are being produced/ tested/ integrated for the fibre optic

communication network, shall be available to the Employer. At all times the Employer shall have full facilities for unrestricted inspection of such materials or equipment. To facilitate this, the Contractor shall submit for the Employer approval, a comprehensive Quality Assurance Plan using ISO 9000 as a general guideline. In addition, the Quality Assurance Plan shall satisfy the following:

- (a) Sufficient office facilities, equipment, and documentation necessary to complete all inspections and to verify that the equipment is being fabricated and maintained in accordance with the Specification shall be provided by the Contractor to the Employer.
- (b) Inspections to be performed by the Employer will include visual examination of hardware, cable dressings and labeling. Contractor's documentation will also be examined to verify that it adequately identifies and describes all offered items and spare parts.
- (c) Access to inspect the Contractor's standards, procedures, and records that are applicable to the supplied equipment shall be provided to the Employer. Documents will be inspected to verify that the Contractor has performed the required quality assurance activities.
- (d) The inspection rights described above shall also apply to sub Contractors who are responsible for supplying major components described in this Specification. These items shall be inspected and tested at the sub Contractor's factory by the Employer's representatives prior to shipping this equipment to the Contractor's facility or directly to the Employer.
- (e) The above inspection rights shall also apply to sub Contractors supplying assemblies, subassemblies and components. However, such items will normally be inspected and tested by the Employer's representatives at the Contractor's site before acceptance.

4.2 Test Plans and Procedures

Test plans and test procedures for both factory and site acceptance tests shall be provided by the Contractor. Test plans and test procedures shall ensure that each factory and site test is comprehensive and verify all the features of the equipment to be tested. Test plans and test procedures shall be modular to allow individual test segments to be repeated upon request.

The Contractor shall submit a Test Schedule for the Employer's approval within one (1) week after the award of contract for Type Tests and three (3) months after the award of contract for all other tests. The test schedule shall list the tests to be carried out, and the approximate test duration. The test periods shall also be indicated in the PERT chart or equivalent for the work.

The Contractor shall give the Employer twenty one (21) days written notice of any material being ready for testing. Fifteen days prior to the scheduled testing, the Employer shall provide written notice to the Contractor of any drawings, equipment, material, or workmanship which, in the Employer's opinion, are not compliant to the specification. The Contractor shall give due consideration to such objections, if valid, effecting the corrections as necessary or shall prove, in writing, that said modifications are unnecessary for contract compliance.

4.2.1 Factory and Site Test Plans

A test plan for factory and site acceptance tests shall be submitted for approval, at least four (4) weeks before the start of testing. The test plan shall be a single overview document that defines the overall schedule and individual responsibilities associated with conducting the tests, documenting the test results, and successfully completing the test criteria. Test Plans shall include, at a minimum, the information contained in Table 4-1.

Table 4-1
Factory & field Test Plan Requirements

Item:	Description:
1.	Test schedule
2.	Record-keeping assignments, procedures and forms
3.	Procedures for monitoring, correcting and retesting variances
4.	Procedures for controlling and documenting all changes made to the communications equipment after the start of testing

4.2.2 Test Procedures

Test procedures for factory and site testing shall be submitted for the Employer approval at least four (4) weeks before each individual test. Fully approved test procedures shall be submitted to the Employer at least four weeks prior to the commencement of testing. Testing shall not commence without approved test procedures. At a minimum, test procedures shall include the items listed in Table 4-2.

All test equipment and/or instruments shall bear calibration stickers indicating valid calibration on and beyond the testing date. The time lapsed since last calibration shall not exceed the test equipment/ jig manufacturer recommended calibration interval or the interval recommended in the test lab's internal quality procedures.

The Contractor shall ensure that all testing will be performed by qualified testing personnel well experienced in performing such tests.

Table 4-2
Test Procedure Requirements

Item:	Description:
1.	Test Title and Revision Level, if applicable
2.	List of Standard(s) complied with
3.	Function(s) / parameter(s) to be tested
4.	Purpose of each test segment
5.	List of required test equipment
6.	Description of any special test conditions or special actions required. This includes complete descriptions, listings and user interface procedures for all special hardware and software tools and/or display formats to be used during the test.
7.	Test setup including test configuration block diagrams and/or illustrations.
8.	Test procedures to be followed.
9.	Required inputs and expected outputs for each test segment
10.	Acceptance criteria for each test segment.
11.	List of test data to be supplied by the Contractor(s) and copies of any certified data to be used
12.	Format of test reports.

4.2.3 Test Records

Complete and indexed records of all factory and site acceptance tests results shall be maintained and provided to the Employer by the Contractor in hardcopy. The records shall be keyed to the steps enumerated in the test procedures. The minimal items required in test records are described in Table 4-3.

Table 4-3
Test Record Requirements

Item:	Description:
1.	Test Title and Revision Level, if applicable; contract references
2.	Date and time for test start and test completed
3.	Test title and reference to the appropriate section of the test procedures
4.	Description of any special test conditions or special actions taken (Includes test-case data).
5.	Test results for each test segment including an indication of Passed, Conditional Pass, Incomplete or Failed.
6.	Test procedure modifications made during testing.
7.	Variance Report(s) tracking information and copies (if variance(s) was detected).
8.	Contractor's test engineer(s) identification, signature and remarks
9.	Employer's test witness identification, signature and remarks
10.	List of all attachments

Table 4-3
Test Record Requirements

Item:	Description:
11.	Attachments (including system logs, printouts, variances, hard copies of visual test result displays, etc.)

All principle test records, test certificates and performance curves shall be supplied for all tests carried out as proof of compliance with the specifications and/or each and every specified test. These test certificates, records and performance curves shall be supplied for all tests, whether or not they have been witnessed by the Employer within the specified duration after the completion of test. Information given on such test certificates and curves shall be sufficient to identify the material or equipment to which the certificates refer, and shall also bear the Contractor's reference and heading.

4.2.4 Rejection of Elements

Any item or component which fails to comply with the requirements of this Specification in any respect, at any stage of manufacture, test, erection or on completion at site may be rejected by the Employer either in whole or part as considered necessary.

Material or components with defects of such a nature that do not meet the requirements of the Specification by adjustment or modification shall be replaced by the Contractor at his own expense. After adjustment or modification, the Contractor shall submit the items to the Employer for further inspection and/or tests.

4.2.5 Test Periods Defined

The terminology used in Volume I, General Conditions of Contract and their correlation with the tests requirements described within this section is as follows:

Pre-Commissioning & Commissioning Period - The Site Acceptance Test (SAT)

Operational Acceptance - Successful completion of SAT

4.3 Type Testing

"Type Tests" shall be defined as those tests which are to be carried out to prove the design, process of manufacture and general conformity of the materials to this Specification. Type Testing shall comply with the following:

- (a) All equipment being supplied shall conform to type tests as per technical specification.

- (b) Type Tests shall be certified or performed by reputed laboratories using material and equipment data sheets and test procedures that have been approved by the Employer. The test procedures shall be formatted as defined in the technical specifications and shall include a complete list of the applicable reference standards and submitted for Employer approval at least four (4) weeks before commencement of test(s). The Contractor shall provide the Employer at least 30 days written notice of the planned commencement of each type test.
- (c) The Contractor shall provide a detailed schedule for performing all specified type tests. These tests shall be performed in the presence of a representative of the Employer.
- (d) The Contractor shall ensure that all type tests can be completed within the time schedule offered in his Technical Proposal.
- (h) In case of failure during any type test, the Supplier is either required to manufacture a fresh sample lot and repeat all type tests successfully or repeat that particular type test(s) at least three times successfully on the samples selected from the already manufactured lot at his own expenses. In case a fresh lot is manufactured for testing then the lot already manufactured shall be rejected.

4.3.1 Type Test Samples

The Contractor shall supply equipment/material for sample selection only after the Quality Assurance Plan has been approved by the Employer. The sample material shall be manufactured strictly in accordance with the approved Quality Assurance Plan. The Contractor shall submit for Employer approval, the type test sample selection procedure. The selection process for conducting the type tests shall ensure that samples are selected at

random. At least three samples of each of the proposed equipment shall be offered for selection, out of which one sample for each equipment shall be selected.

4.3.2 List of Type Tests

The type testing shall be conducted on the following equipment

- (a) SDH Equipment with all types of cards (optical card, Tributary card or any other equipment as part of repeater less links)

4.3.2.1 List of type test to be conducted on Telecom equipment

The type tests for SDH Equipment with all types of cards, Primary Multiplexer & Drop – Insert Mux with subscriber interface card and DACS are described below:

4.3.2.1.1 Temperature and Humidity Tests

The tests listed below are defined in IEC Publication 60068.

(a) Low Temperature Test: Operation to Specifications

Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for sixteen (16) hours. Its performance is checked during the test.
- (2) Degree of Severity: Test shall be done at 0°C
- (3) Acceptance Criteria: No degradation of performance during and after the test.

(b) Low Temperature Test : Operation without Damage

Low temperature tests shall be conducted as defined in IEC Publication 60068-2-1, test method Ad, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 72 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).

- (2) Degree of Severity: Test shall be done at -10° C
- (3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(c) Dry Heat Test: Operation to Specifications

Dry heat test shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test.
- (2) Degree of Severity: As per table 5-1: operation to specification range.
- (3) Acceptance Criteria: No degradation of performance during and after the test.

(d) Dry Heat Test: Operation without Damage

Dry heat tests shall be done as defined in IEC Publication 60068-2-2, test method Bd, with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 96 hours. Its performance is checked during the test and after the test as soon as the thermal equilibrium is reached at the room temperature (*Post-test*).
- (2) Degree of Severity: Test shall be done at 55°C.
- (3) Acceptance Criteria: Degradation of performance is allowable during the test, however there shall be no degradation of performance in the *post-test*.

(e) Damp Heat Test

Damp heat testing reveals aging with respect to the humidity level and applies basically to electronic equipment. This test shall be done as defined in IEC Publication 60068-2-3 with the following specifications:

- (1) Test Duration: The equipment is started up as soon as thermal equilibrium has been reached and operated for 10 days. Its performance is checked during the test.

- (2) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

(f) Temperature Variation Test

Temperature variation testing shall be as per IEC Publication 60068-2-14 (Gradual Variations, Method Nb). The equipment shall be powered on and various parameters shall be monitored continuously during the test period.

- (1) Number of cycles required is five (5)
- (2) The degree of severity: temperature TL:0°C, TH: As per table 5-1 (Operation to specification range)
- (3) Cycle duration for each temperature is three (3) hours.
- (4) Ramp : 1 °C/minute.
- (5) Acceptance Criteria: The equipment shall meet the specified requirement and there shall not be any degradation in BER.

4.3.2.1.2 Power Supply and EMI/EMC tests

The test procedure and acceptance criteria shall be as defined in IEC 60870-2-1.

(a) Immunity Tests

The list of Immunity tests are specified below in Table 4-4:

Table 4-4: Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
1	Voltage Fluctuations	Yes	Yes	N/A	N/A	Table 11 of IEC 60870-2-1: 1995 - Level : 1
2	Voltage dips and Interruptions	Yes	Yes	N/A	N/A	
3	100/1300 µs surge	Yes	Yes	N/A	N/A	Table 12 of IEC 60870-2-1: 1995
4	1.2/50 - 8/20 µs surges	Yes	Yes	Yes	N/A	Table 12 of IEC 60870-2-1: 1995 - Level : 4
5	Fast transient bursts	Yes	Yes	Yes	Yes	

Table 4-4: Recommended Immunity Tests

S. No.	Immunity Test	AC Power Supply	DC Power Supply	Control & Signal	Telecom Line	Para-metres
6	Damped oscillatory waves	Yes	Yes	Yes	Yes	
7	10/700 μs surges	N/A	N/A	N/A	Yes	
8	Electrostatic discharge	Yes				Table 13 of IEC 60870-2-1: 1995 - Level : 4
9	Power frequency magnetic field	Yes				Table 14 of IEC 60870-2-1: 1995 - Level : 4
10	Damped oscillatory magnetic field	Yes				
11	Radiated electromagnetic field	Yes				Table 15 of IEC 60870-2-1: 1995 - Level : 4
12	Power Frequency voltage on control and signal lines	N/A	N/A	Yes	Yes	IEC 61000-4-16 : 2002-07 Level : 4
13	DC voltage on control and signal lines	N/A	N/A	Yes	N/A	IEC 61000-4-16 : 2002-07 Level : 4
-End of Table-						

(b) Emission Tests

The list of Emission tests are specified below in Table 4-5

**Table 4-5:
Recommended Emission Tests**

S. NO.	Emission test	AC Power Supply	DC Power Supply	Contr ol & Signal	Telecom Line	Para-metres
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**Table 4-5:
Recommended Emission Tests**

S. NO.	Emission test	AC Power Supply	DC Power Supply	Contr ol & Signal	Telecom Line	Para- metres
1	LF disturbance voltages CCITT recommendation P.53	N/A	Yes	N/A	N/A	Table 17 of IEC 60870-2-1: 1995 - Class : B
2	Transient disturbance voltages	Yes	Yes	N/A	N/A	
3	RF disturbance voltages CISPR 22	Yes	Yes	N/A	N/A	
4	RF disturbance currents CISPR 22	N/A	N/A	N/A	Yes	
5	RF radiated fields CISPR 22	Yes				
-End Of Table-						

(c) Insulation Withstand Voltages

As per section 6 of IEC 870-2-1. Recommended class : VW1 of Table 18.

4.3.2.1.3 Mechanical Tests

(a) Mechanical Vibration Test

The procedure for this test is described in IEC Publication 60068-2-6. The testing procedure shall be carried out in the sequence 8.1 + 8.2.1 + 8.1 as described in document 60068-2-6.

For the vibration response investigation (clause 8.1 of 60068-2-6), the test shall be carried out over a sweep cycle under the same conditions as for the endurance test (described later), but the vibration amplitude and the sweep rate may be decreased below these conditions so that the determination of the response characteristics can be obtained.

The endurance test conditions are selected according to the vibration withstand requirements.

Transportation tests shall be performed with the equipment packed according to the Contractor's specifications.

(b) Shock Test

The procedure of this test is defined in IEC Publication 60068-2-27 (each test) with a semi-sinusoidal shape (clause 3.1.1.2).

The recommended severity shall be $A = 294 \text{ m/s}^2$, $D = 18 \text{ ms}$. Three shocks per axis per direction shall be applied to the equipment packed according to the Contractor's specifications.

Or Free Fall Test

This test could be performed as an alternative to the shock or Bump test. The procedure is defined in IEC publication 60068-2-32. The equipment shall be packed according to the Contractor's specifications. The drop height shall be defined in accordance with IEC 68-2-32. The surface of the packing case which comes into contact with the ground is the surface on which the packing case normally rests; if the packing does not have any features (inscription, special shape, etc.) identifying this surface, the test is carried out successively on all the surfaces of the packing.

Or Bump Test

This test could be performed as an alternative to Shock test or Free Fall test. The procedure is defined in IEC 60068-2-29.

4.4 Factory Acceptance Tests

Factory acceptance tests shall be conducted on randomly selected final assemblies of all equipment to be supplied. Factory acceptance testing shall be carried out on SDH Equipments, associated line & tributary cards, Termination Equipments (Primary Mux, Drop/Insert, DACS, associated Subscriber Line Interface Cards etc), Network Management System etc. and all other items for which price has been identified separately in the Bid Price Schedules.

Equipment shall not be shipped to the Employer until required factory tests are completed satisfactorily, all variances are resolved, full test documentation has been delivered to the Employer, and the Employer has issued Material Inspection & Clearance Certificate (MICC). Successful completion of the factory tests and the Employer approval to ship, shall in no way constitute final acceptance of the system or any portion thereof. These tests shall be carried out in the presence of the Employer's authorised representatives unless waiver for witnessing by Employer's representatives is intimated to the contractor.

Factory acceptance tests shall not proceed without the prior delivery to and approval of all test documentation by the Employer.

The factory acceptance test shall demonstrate the technical characteristics of the equipment in relation to this specifications and approved drawings and documents. List of factory acceptance tests for Fibre Optic Transmission system, Termination Equipment Sub-system and NMS are given in specified Tables in this section. This list of factory acceptance tests shall be supplemented by the Contractor's standard FAT testing program. The factory acceptance tests for the other items shall be proposed by the Contractor in accordance with technical specifications and Contractor's (including Sub-Contractor's / supplier's) standard FAT testing program. In general the FAT for other items shall include at least: Physical verification, demonstration of technical characteristics, various operational modes, functional interfaces, alarms and diagnostics etc.

For Test equipment & clock, FAT shall include supply of proper calibration certificates, demonstration of satisfactory performance, evidence of correct equipment configuration and manufacturer's final inspection certificate/ report.

4.4.1 Sampling for FAT

From each batch of equipment presented by the Contractor for Factory acceptance testing, the Employer shall select random sample(s) to be tested for acceptance. Unless otherwise agreed, all required FAT tests in the approved FAT procedures, shall be performed on all samples. The Sampling rate for the Factory acceptance tests shall be minimum 10% of the batch size (minimum 1) for all items. The physical verification shall be carried out on 100% of the offered quantities as per the approved FAT procedure. In case any of the selected samples fail, the failed sample is rejected and additional 20% samples shall be selected randomly and tested. In case any sample from the additional 20% also fails the entire batch may be rejected. In case a number of equipments are required for demonstration of the performance of any equipment during FAT, the sample size shall be taken as that number of equipments which are necessary to demonstrate the performance, irrespective of the percentage.

Since FAT testing provides a measure of assurance that the Quality Control objectives are being met during all phases of production, the Employer reserves the right to require the Contractor to investigate and report on the cause of FAT failures and to suspend further testing/ approvals until such a report is made and remedial actions taken, as applicable.

4.4.2 Production Testing

Production testing shall mean those tests which are to be carried out during the process of production by the Contractor to ensure the desired quality of end product to be supplied by him. The production tests to be carried out at each stage of production shall be based on the Contractor's standard quality assurance procedures. The production tests to be carried out shall be listed in the Manufacturing Quality Plan (MQP), alongwith information such as sampling frequency, applicable standards, acceptance criteria etc.

Table 4-6:
Factory Acceptance Testing for Fibre Optic Transmission System

Item:	Description:
1.	Physical inspection for conformance to DRS, BOQ, drawings and appearance of equipment
2.	Optical output power
3.	Transmitter lightwave spectral analysis
4.	Low receive level threshold
5.	Generation of bit error rate curve
6.	Measurement of analog and digital service channel parameters as well as service channel functionality
7.	Performance of supervision, alarm, Craftsperson interface, diagnostics, loop backs etc.
8.	Electrical interface tests which include: output and input jitter, bit error rate, pulse shape, cable compensation, and line rate tolerance for multiplexers
9.	At a minimum tests on Ethernet interface shall include demonstration of ping test, throughput test, Latency test, Packet Loss test as per RFC 2544
11.	Simulation of failure conditions and failover of each redundant unit.
12.	Test of spare card slots
13.	Checks of power supply/converter voltage margins
14.	Random inspections to verify the accuracy of documentation
15.	Test of spare parts/modules/cards as per applicable tests

4.5 Site Acceptance Tests

The Contractor shall be responsible for the submission of all equipment & test equipment supplied in this contract for site tests and inspection as required by the Employer. All equipment shall be tested on site under the conditions in which it will normally operate.

The tests shall be exhaustive and shall demonstrate that the overall performance of the contract works satisfies every requirement specified. At a minimum Site Acceptance Testing requirement for Telecom equipment, NMS etc. is outlined in following section. This testing shall be supplemented by the Contractor's standard installation testing program, which shall be in accordance with his quality plan(s) for Telecom equipment installation.

During the course of installation, the Employer shall have full access for inspection and verification of the progress of the work and for checking workmanship and accuracy, as may be required. On completion of the work prior to commissioning, all equipment shall be tested to the satisfaction of the Employer to demonstrate that it is entirely suitable for commercial operation.

4.5.1 Phases for Site Acceptance Testing

The SAT shall be completed in following phases:

4.5.1.1 Installation Testing

The field installation test shall be performed for all equipment at each location. If any equipment has been damaged or for any reason does not comply with this Specification, the Contractor shall provide and install replacement parts at its own cost and expense.

In the installation test report, the Contractor shall include a list of all hardware or components replaced or changed between the completion of factory tests and the start of field tests and show that documentation and spare parts have been updated.

The minimal installation testing requirements for fiber optic transmission subsystem, Termination equipment sub-system and NMS are provided in respective Tables in this section.

4.5.1.2 Link Commissioning Tests

The commissioning tests shall verify that communication can be performed over the fiber optic link under test. Delay measurement, Bit Error measurements & service channel performance monitoring shall be made on the fibre optic links to verify compliance with designed link performance.

For Ethernet interface: At a minimum the following test requirements shall be demonstrated as per RFC 2544:

- a) Ping test
- b) Throughput test
- c) Latency test
- d) Packet Loss

10% of the total links (Chosen by the Employer, generally to cover links from all configurations used) shall be tested for a duration of 12 Hours. Rest of the links shall be tested for 1 Hour. In case a link does not meet the performance requirements during 1 hour, then the duration of the test shall be increased to 12 hours.

In case any link does not meet the performance requirements during 12 hour, then the cause of failure shall be investigated and the test shall be repeated after rectifying the defects.

This phase of testing shall be conducted by the Contractor and witnessed by the Employer. Field adjustments shall be made to meet established standard, however if the field adjustments fail to correct the defects the equipments may be returned to the Contractor for replacement at his own expense. In case any adjustments are required to be made during the interval of the test then the test shall be repeated.

4.5.1.3 Integrated Testing

Prior to commencement of integrated testing the overall system shall be configured as required to provide all the channels required to interconnect the various User's interfaces. The integrated testing for a batch shall include end-to-end testing of back-bone network included in that batch. Integrated testing for last batch shall include testing of the entire back-bone. The intent of integrated testing is to demonstrate that the equipment is operational end to end under actual conditions, that all variances identified during factory and field installation and communications testing have been corrected, and that the communication equipment is compatible with other equipment at all locations. The Integrated System Test shall include all fibre optic transmission equipment, the network management subsystem and other components.

At a minimum the following tests shall be included in the integrated testing:

- (1) Equipment configuration shall be checked to establish that it supports the channel routing.
- (2) Testing of Craft Terminal to demonstrate proper operation of all functions: Configuration Management, Performance Management, Fault, Management and Security management. All the standard features of the Craft Terminal based NMS shall be demonstrated for proper functioning.
- (3) Demonstration of Protection switching and synchronization of equipment as per synchronization plan.

Table 4-7
Fibre Optic Transmission system Installation Testing

Item:	Description:
1.	Physical Inspection for conformance to drawings, rack elevations and appearance of equipment and cabling
2.	Station power supply input and equipment power supply (DC-DC converter) output voltage measurements
3.	Terminal transceiver performance testing (Tx power, Tx spectrum, receive signal strength, connector losses etc.)
4.	Service channel performance
5.	Craftsperson interface, alarm and control functional performance

6.	Rack and local alarms: No alarms shall be present and all alarms shall be demonstrated to be functional
7.	Network management interface and supervision performance
8.	Correct configuration, level setting & adjustments and termination of Input/output interfaces
9.	Proper establishment of Safety and signalling earthing system and resistance to ground to be checked.
10.	Simulation of failure conditions and failover of protected components.

-----**End of this Section**-----

5.1 Miscellaneous Supplies

The Contractor shall provide all required consumable and non-consumable supplies necessary to support all installation and test activities through final operational acceptance. However, if there are any problems in the SAT and additional consumables are required, the same shall also be supplied by the Contractor at no additional cost.

5.2 Documentation

The Contractor shall submit following documents during detailed engineering:

- (a) Data Requirement sheets
- (b) Link Budget calculations
- (c) MQP, FQP
- (d) Bill of Quantity including mandatory spares
- (e) Previous Type test reports
- (f) Factory Test report
- (g) Manuals for each equipment
- (h) Schematic drawing
- (i) Numbering, Marking, labelling document
- (j) Synchronization plan
- (k) Test schedule
- (l) Training manual
- (m) Configuration diagram
- (n) Transportation & handling Procedure
- (o) Installation Manuals
- (p) Maintenance Manuals

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PROJECT: Construction of 132KV L4 & L5 Line Boys BTPS
after dismantling old existing boys.

SHT. TITLE : SINGLE LINE DIAGRAM

SUBSTATION : 132/33KV GRID SUB-STATION

CUSTOMER : BIHAR STATE POWER TRANSMISSION CO. LTD., (BSPCL)

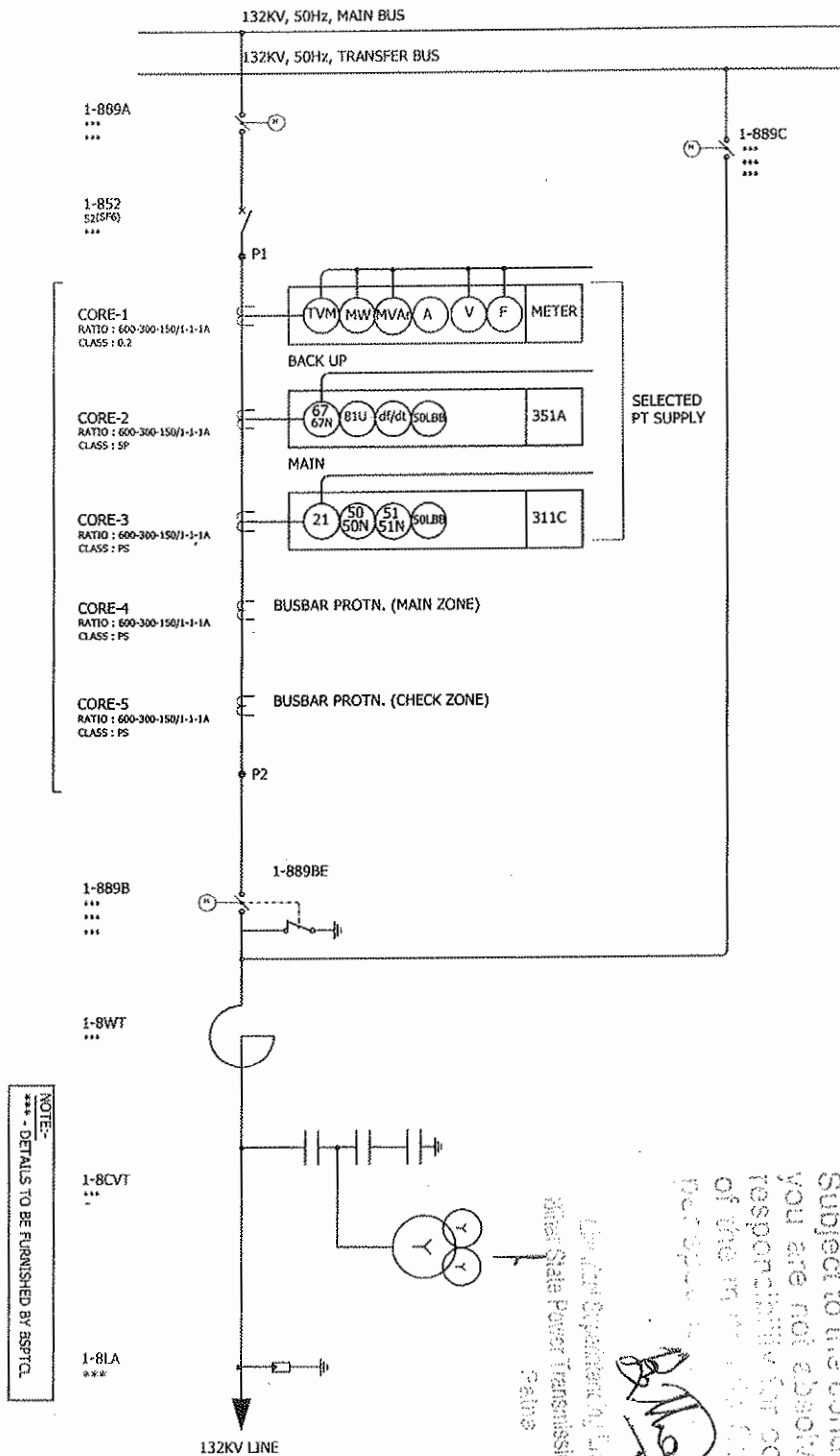
REV	DATE	SUBMISSION	REVISION COMMENTS	PREPARED	REVIEWED	APPROVED
0	17.06.15			SACHITH	STHIT SHARMA	HARI

MANUFACTURER:
SCHWEITZER ENGINEERING LABORATORIES PVT. LTD.,
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METAL SUBURB PLACE, RYAMUNJA, DELHI-110028.

SEL
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DWG. NO : SEL(1)/BSPCL/170615/132KV LINE/SC
DWG. TITLE: 132KV LINE CONTROL & RELAY PANEL
P.O. NO.: PO/PTC/SEL/BSPCL/77-PR/06/14-15
NIT REF.: 77/PR/BSTCL/2014

THIS SHT : 02
NEXT SHT : 03
TOTAL SHT : 30



Subject to the conditions that you are not absolved of the responsibility for correctness of the information supplied hereon.

Approved by
17.10.15

Chief Engineer (Trans)
Bihar State Power Transmission Company Ltd.
Patna

Srv. Line Item	Item Description	Item/Service Code	Qty	Unit	Estimated Amount	Total Amount (Excl. GST)
10	132kV,1250 A,31.5kA,SF6 CB,with SS,MB&TC	M7320100014	1.00	NO	9,56,495.28	9,56,495.28
20	132kV,1250A,31.5kA Isolator,Two earth SW	M7320100015	1.00	NO	3,61,747.36	3,61,747.36
30	132kV,1250A,31.5kA Isolator,No earth SW	M7320100016	2.00	NO	2,71,994.32	5,43,988.64
40	132 kV,150/1-1-1-1-1A,0.2s class CT	M7320100017	3.00	NO	3,34,329.84	10,02,989.52
50	132kV,8800 pF CVT	M7320100018	3.00	NO	2,62,815.28	7,88,445.84
60	132 kV,120kV SA/LA with TC & SC	M7320100019	3.00	NO	50,894.48	1,52,683.44
70	132kV, All Erection Hardware of Line Bay	M7320100020	1.00	Set	7,16,092.00	7,16,092.00
80	132 kV Solid Core, BPI	M7320100021	3.00	NO	12,882.48	38,647.44
90	132kV, CRP complete in all respect	M7320100022	1.00	NO	11,68,072.88	11,68,072.88
100	132kV, CE, SDH - Base Equipment	M7320100023	2.00	NO	11,36,884.32	22,73,768.64
110	132kV, CE, SDH - Optical Card - S 4.1	M7320100024	8.00	NO	9,216.22	73,729.76
120	132kV, CE, SDH - Digital Prot Buscoupler	M7320100025	4.00	NO	4,54,666.16	18,18,664.64
130	132kV,CE, Unarm FO cable-24 fibre DWSM	M7320100028	1.00	KM	83,675.28	83,675.28
140	132kV,CE,PLB HDPE pipe O.D. 40mm	M7320100029	1.00	KM	72,097.10	72,097.10
150	132kV,3 Phase,4wire,0.2S,ABT Meter	M7320100030	2.00	NO	1,19,151.50	2,38,303.00
160	132kV,ABT Meter panel with 4 no. of rack	M7320100031	1.00	NO	1,20,257.80	1,20,257.80
170	132kV, DCU with box for ABT Meter	M7320100032	1.00	Set	1,91,180.60	1,91,180.60
180	132kV, 8port10/100 Mbps NS for ABT	M7320100033	1.00	NO	13,023.24	13,023.24
190	132kV,Comm cable for ABT Meter	M7320100034	500.00	M	45.57	22,785.00
200	132kV,GPRS Modem for ABT Meter	M7320100035	1.00	NO	5,441.90	5,441.90
210	132kV, Outdoor Lighting Panel,Type-ACP2	M7320100036	1.00	NO	40,491.36	40,491.36
220	132kV, Outdoor Lighting-200/220 watt LED	M7320100037	8.00	NO	28,042.56	2,24,340.48
230	Power cables (PVC)- 1.1kV, 3.5C X 35 mm2	M7200020009	1.00	KM	3,21,919.52	3,21,919.52
240	4C x 16 mm2 (Al) Armoured Cable	M7200020002	1,000.00	M	181.06	1,81,060.00
250	5*2.5(Cu),1.1kV Grade,XLPE INS cable	M7201090009	1,000.00	M	214.31	2,14,310.00
260	7C X 2.5 SQMM ARMoured XLPE CU CABLE	M7200140004	1,000.00	M	275.28	2,75,280.00
270	10*2.5(Cu),1.1kV Grade,XLPE INS cable	M7201090010	2,000.00	M	365.38	7,30,760.00
280	cable (PVC) - 1.1 kV, 27C X 2.5 mm2	M7201090013	1.00	KM	9,35,532.00	9,35,532.00
290	40MM MS rod for earth mat	M7610040010	10.00	MT	1,03,204.40	10,32,044.00
300	75x12 mm G.I Flats	M7610040011	5.00	MT	1,07,993.60	5,39,968.00
310	50 X 6 MM GI Strip	M7320100059	5.00	MT	1,07,993.60	5,39,968.00
320	Non Treated Earth Pit (All materials)	M7610040012	3.00	NO	7,887.44	23,662.08
330	132kV, HT Lattice structure	M7320100038	10.00	MT	1,12,964.80	11,29,648.00
340	132kV, MS Lattice structure	M7320100039	10.00	MT	1,09,506.80	10,95,068.00
350	132kV, Pipe Type structure	M7320100040	8.00	MT	1,12,964.80	9,03,718.40
360	132kV,Cable Rack+pre-fab galv cable tray	M7320100041	4.00	MT	1,20,154.32	4,80,617.28
370	11KV Disc Insulator (120/90KN)	M7320100042	230.00	NO	838.24	1,92,795.20
380	132kV,Galvaniz steel wire for OH Shield	M7320100043	1.00	LS	1,94,255.36	1,94,255.36
390	132kV, CB , Tripping Coil	M7320100044	2.00	NO	3,808.48	7,616.96
400	132kV, CB , Closing Coil	M7320100045	2.00	NO	3,808.48	7,616.96
410	132kV, CB , SF6 Gas Cylinder (26kg)	M7320100046	1.00	NO	38,237.68	38,237.68
420	132kV, SF6 gas refilling device	M7320100047	1.00	NO	5,86,040.00	5,86,040.00
430	132kV, CB	M7320100048	1.00	NO	3,91,368.64	3,91,368.64
440	132kV, Isolator	M7320100049	1.00	NO	2,54,366.32	2,54,366.32
450	132 kV, CT	M7320100050	2.00	NO	2,56,364.16	5,12,728.32
460	132 kV, CVT, 8800 pF	M7320100051	2.00	NO	2,29,975.20	4,59,950.40
470	120 kV surge arrester for 132kV	M7320100052	3.00	NO	47,201.44	1,41,604.32
480	132 kV female contact of Isolator 1250 A	M7320100053	2.00	NO	10,405.20	20,810.40
490	132kV, T-connector for Moose to Moose	M7320100009	10.00	NO	1,817.92	18,179.20
500	132kV, PG clamp for Panther to Panther	M7320100054	10.00	NO	1,817.92	18,179.20
510	132kV, Mid span joint for panther	M7320100055	5.00	NO	1,229.28	6,146.40
520	132kV, T-connector for Panther to Moose	M7320100056	5.00	NO	1,727.44	8,637.20
530	132kV,Palm connector for Moose to Moose	M7320100057	10.00	NO	2,558.40	25,584.00
540	132kV, CT connector for Moose conductor	M7320100058	5.00	NO	4,933.76	24,668.80
550	132kV, ACSR Panther Conductor	M7320100001	1.00	KM	2,50,689.92	2,50,689.92
560	132kV,90KN Long Rod Porcelain Insulator	M7320100002	12.00	NO	6,859.84	82,318.08
570	132kV,70 KN Long Rod Porcelain Insulator	M7320100003	3.00	NO	6,394.96	19,184.88
580	132kV,Single Tension Fitting for panther	M7320100004	12.00	NO	3,518.32	42,219.84
590	Single Suspension Pilot FittingforPanther	M7320100005	3.00	NO	2,371.20	7,113.60
600	132kV, ACSR Moose Conductor	M7320100006	1.00	KM	4,83,145.52	4,83,145.52
610	132kV, Single Tension Fittings for Moose	M7320100007	6.00	NO	17,014.40	1,02,086.40
620	Single Suspension Pilot Fitting forMoose	M7320100008	3.00	NO	5,289.44	15,868.32
630	132kV, T-connector for Moose to Moose	M7320100009	9.00	NO	1,817.92	16,361.28
640	T-connector for Panther-Panther to Moose	M7320100010	6.00	NO	1,727.48	10,364.88
650	PG clamp for Moose to Moose	M7320100011	6.00	NO	1,878.26	11,269.56
660	Pipe type Structure (Bay - 106 & Line)	M7320100012	8.00	MT	1,12,964.80	9,03,718.40
670	75x12 mm G.I Flats	M7610040011	5.00	MT	1,07,993.60	5,39,968.00
680	50 X 6 MM GI Strip	M7320100059	5.00	MT	1,07,993.60	5,39,968.00
690	11KV Disc Insulator (120/90KN)	M7320100013	230.00	NO	838.24	1,92,795.20
700	Non Treated Earth Pit (All materials)	M7610040012	3.00	NO	7,887.44	23,662.32
Total						2,54,59,996.04

SL	Ser. Line Item	Item Description	Item/Service Code	Qty	Unit	Estimated Amount	Total Amount (Excl. GST)
710	Service - Dismantling of Bays Equipments						4,90,184.84
	10	Dismantling of 132KV CB	2000001685	1.00	NO	17,832.36	17,832.36
	20	Dismantling of 132KV CT	2000001686	3.00	NO	3,170.58	9,511.74
	30	Dismantling of 132KV LL Isolator	2000001687	9.00	NO	4,606.98	41,462.82
	40	Dismantling of 132KV LA	2000001688	3.00	NO	1,386.84	4,160.52
	50	Dismantling of 132KV BPI	2000001689	6.00	NO	373.20	2,239.20
	60	Dismantling of 132KV CVT	2000001690	3.00	NO	3,170.58	9,511.74
	70	Dismantling of 132KV PT	2000001691	3.00	NO	3,170.58	9,511.74
	80	132Kv Jumper Opening/ connection in GSS.	2000001692	75.00	NO	136.00	10,200.00
	90	132kv Dismantling of Substation Structure	2000001693	10.00	MT	14,153.00	1,41,530.00
	100	132kv Dismantling of Cables	2000001694	1,500.00	M	24.00	36,000.00
	110	132kv - Dismantling of Tower including c	2000001695	5.16	MT	17,691.00	91,320.94
	120	132KV - Dismantling of Gantry	2000001696	8.26	MT	14,153.00	1,16,903.78
720	Erection of Bay 106 & Associated lines						4,90,962.29
	10	106 - ETC of 132kv SF6 CB without founda	2000001697	1.00	NO	42,458.00	42,458.00
	20	Bay - 106 ETC of 132kv CT (CVT/PT)	2000001698	3.00	NO	7,549.00	22,647.00
	30	Bay 106 - ETC of 132kv LL isolator	2000001699	3.00	NO	10,969.00	32,907.00
	40	Bay 106 - ETC of 132kv CVT	2000001700	3.00	NO	7,549.00	22,647.00
	50	Bay 106- ETC of 132kv LA	2000001701	3.00	NO	3,302.00	9,906.00
	60	BAY - 106 - Erection of 132KV BPI	2000001702	2.00	NO	622.00	1,244.00
	70	Bay 106 - Closing of 132kv Jumpers	2000001703	30.00	NO	136.00	4,080.00
	80	Bay 106-Replacement of 132kv Bus bar	2000001704	100.00	M	206.00	20,600.00
	90	106Laying of cable10cx2.5to18cx2.5&10cx6	2000001705	1,500.00	M	40.00	60,000.00
	100	Bay 106 - Erection of SubSt. Structure	2000001706	8.00	MT	6,486.00	51,888.00
	110	106-Erect of 75x12 mm GI flats	2000001707	5.00	MT	6,348.00	31,740.00
	120	106 - Erection of 50x6 mm GI flats	2000001708	5.00	MT	12,050.00	60,250.00
	130	Bay 106 - Erection of DD Type tower	2000001709	6.77	MT	7,076.00	47,883.29
	140	Replacement of 1 no panther conductor	2000001710	6.00	PSN	10,098.00	60,588.00
	150	106-OPGW/Earthwire stringing & other wor	2000001711	1.00	PSN	7,184.00	7,184.00
	160	Bay 106 - Non Treated Earth pit	2000001712	3.00	NO	4,980.00	14,940.00
730	Erec & Comm of Bay 107						15,77,610.67
	10	107 - E/T/C of 132 KV CB	2000001713	1.00	NO	15,158.00	15,158.00
	20	107 - E/T/C Isolator two earth switch	2000001714	1.00	NO	14,444.00	14,444.00
	30	107 - E/T/C Isolator without EarthSwitch	2000001715	2.00	NO	13,952.00	27,904.00
	40	107 - ETC CT 5 core 0.2s class ,31.5 kA	2000001716	3.00	NO	3,704.00	11,112.00
	50	107 - ETC "8800 pF CVTs (1 phase)	2000001717	3.00	NO	3,913.00	11,739.00
	60	120 kV Surge Arresters (1 phase) - 107	2000001718	3.00	NO	1,374.00	4,122.00
	70	Bay 107 Line Bay erection	2000001719	1.00	Set	72,174.00	72,174.00
	80	107 - Erection of 132kv BPI	2000001720	3.00	NO	622.00	1,866.00
	90	107-Erection of 132kv CRP	2000001721	1.00	NO	6,005.00	6,005.00
	100	107-Erection of SDH equipment	2000001722	2.00	NO	7,158.00	14,316.00
	110	107- Installation of Optical Card S4.1	2000001723	8.00	NO	2,854.00	22,832.00
	120	107-Install of Digital Prot. Coupler	2000001724	4.00	NO	6,209.00	24,836.00
	130	107-Integ&comm of RTU	2000001725	2.00	NO	1,69,121.00	3,38,242.00
	140	107-ITC of OPGW & Comm. equipments	2000001726	1.00	LS	55,252.00	55,252.00
	150	107-Install of 24 fibre DWDM	2000001727	1.00	KM	1,46,250.00	1,46,250.00
	160	107-Install of PLB HDPE pipe O.D. 40 mm	2000001728	1.00	KM	11,958.00	11,958.00
	170	107-I&C of ABT Energy Meter	2000001729	2.00	NO	27,149.50	54,299.00
	180	107- I&C of Metering panel (4 Racks)	2000001730	1.00	NO	57,907.26	57,907.26
	190	107-I&C of DCU	2000001731	1.00	Set	1,15,433.21	1,15,433.21
	200	107-I&C of Network Sw 8 port 10/100 Mbps	2000001732	1.00	NO	1,541.00	1,541.00
	210	107 - Bay - Communication cable	2000001733	500.00	M	51.57	25,785.00
	220	107-I&C of GPRS modem	2000001734	1.00	NO	7,637.20	7,637.20
	230	107-ETC of Lighting panel(Outdoor)Type-2	2000001735	1.00	NO	2,873.00	2,873.00
	240	107- ETC of 3.5C X 35 mm2 cable	2000001736	1.00	KM	31,087.00	31,087.00
	250	107-ETC of 4C X 16 mm2 cable	2000001737	1.00	KM	25,675.00	25,675.00
	260	107-ETC of 5C X 2.5 mm2	2000001738	1.00	KM	27,722.00	27,722.00
	270	107-ETC of 7C X 2.5 mm2	2000001739	1.00	KM	30,827.00	30,827.00
	280	107-ETC of 10C X 2.5 mm2	2000001740	2.00	KM	33,882.00	67,764.00
	290	107-ETC of 27C X 2.5 mm2	2000001741	1.00	KM	41,583.00	41,583.00
	300	107-Erection of 40 mm MS rod	2000001742	10.00	MT	5,546.00	55,460.00
	310	107- Erection of 75 x 12 mm GI flat	2000001743	5.00	MT	6,348.00	31,740.00
	320	107-Erection of 50 x 6 mm GI flats	2000001744	5.00	MT	12,050.00	60,250.00
	330	107-ETC of Earth Pit (Non Treated)	2000001745	3.00	NO	4,980.00	14,940.00
	340	107-Erection of Sub St Lattice Struc(HT)	2000001746	10.00	MT	3,257.00	32,570.00
	350	107-Erect of Sub St Lattice Struc(MS)	2000001747	10.00	MT	3,257.00	32,570.00
	360	107-Erection of Pipe type Struc	2000001748	8.00	MT	3,257.00	26,056.00
	370	107-Erection of Cable Trays & Racks	2000001749	4.00	MT	4,009.00	16,036.00
	380	107- ETC of 11KV Disc Insulator (120/90K	2000001750	230.00	NO	49	11,270.00
	390	107-ETC of Overhead shielding	2000001751	1.00	LS	28,375.00	28,375.00

Total Service Part

25,58,757.80

SL	Ser. Line Item	Item Description	Item/Service Code	Qty	Unit	Estimated Amount	Total Amount (Excl. GST)
710		Civil Works					55,22,400.73
	10	Demolishing R.C.C.		59.42	Cum	1,237.35	73,523.34
	20	Earth work in excavation over areas (ex		991.29	Cum	276.11	2,73,705.08
	30	Filling available excavated earth		792.70	Cum	108.64	86,118.93
	40	PCC 1:3:6		11.47	Cum	3,010.96	34,535.71
	50	PCC 1:4:8		14.97	Cum	2,608.68	39,051.94
	60	PCC 1:5:10		162.50	Cum	2,395.00	3,89,187.50
	70	PCC 1:1:5:3		169.09	Cum	4,110.74	6,95,085.03
	80	Reinforcement for R.C.C- TMTC-500-8mm di		4,509.01	KG	82.86	3,73,616.57
	90	TMTC-500-10mm		576.60	KG	81.19	46,814.15
	100	TMTC-500-12mm		5,352.98	KG	79.61	4,26,150.74
	110	TMTC-500-16mm		2,984.30	KG	80.40	2,39,937.72
	120	TMTC-500-20mm		528.70	KG	80.40	42,507.48
	130	Centring and shuttering-Foundations, foo		289.70	M2	185.53	53,748.04
	140	Columns,Pillars, Piers, Abutments, Posts		864.00	M2	433.49	3,74,535.36
	150	Supplying Bolts and nuts above 300mm		6.42	QTL	6,217.51	39,916.41
	160	Stone aggregate(Single Size)40 mm nomina		219.38	M2	571.21	1,25,312.05
	170	Unskilled labour for spreading gravel an		201.00	NO	358.97	72,152.97
	180	Carriage of materials-Coarse sand (lead		160.66	Cum	892.57	1,43,400.30
	190	Stone aggregate(lead 191 km)from Mirzach		531.84	Cum	3,679.85	19,57,073.02
	200	Difference cost of materials-Cement		93.83	TON	16.42	1,540.66
	210	Seigniorage Fee(Coarse Sand + Stone Chip		34,487.73	LS	1.00	34,487.73
		Total					55,22,400.73

HINDUSTAN URVARAK & RASAYAN LIMITED

(A JOINT VENTURE OF CIL, NTPC, IOCL, FCIL & HFCL)

BARAUNI UNIT

Barauni Urvarak Nagar, Begusarai

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115

[Registered Office SCOPE Minar, Core 4, 9TH Floor, Laxmi Nagar District Center, Delhi-110092]



SECTION – VI

FORMS AND PROCEDURES (NIT)

INDEX

Annexure	Description
1	Techno-Commercial Proposal Bid Form
2	Format for Electronics Payment
3	Tender Acceptance Letter & Letter of authorization to submit bid
4	No deviation Certificate
5	Certificate from CEO/MD/ Legally Authorized Signatory
6	Acceptance to Fraud Prevention Policy of HURL
7	Certificate related to Restrictions on procurement from a Bidder of a country which shares a land border with India
8	Format of Bank Guarantee for Bid Security
9	Format of Performance Bank Guarantee
10	Bank Guarantee Verification Checklist
11	Format for Contract Agreement
12	Work orders subject to tender for qualification
13	Bid Security Declaration Form
14	Self-Certification under Preference to “MAKE IN INDIA” Policy.
15	DECLARATION OF GST (A&B).
16	Proforma of NO DEMAND CERTIFICATE

TECHNO-COMMERCIAL PROPOSAL BID FORM**(To be Submitted on the Letter Head of Bidder)****Bidder's Techno-Commercial Proposal Ref. No.:**

Bidder's Name & Address :

Date:

Person to be contacted :

Designation :

Tel. No(s) :

Mobile No. :

Fax No(s) :

E-mail address:

To

Manager (C&M),

HURL Admin Building Office,

Hindustan Urvarak & Rasayan Limited, Barauni,

(A JV of CIL, NTPC, IOCL, FCIL & HFCL)

P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.

Dear Sirs,

1.0 Having examined the Bidding Documents bearing No. Dated..... including its subsequent amendments and clarifications, if any, issued by Owner, the receipt of which is hereby acknowledged, we the undersigned, offer to complete the work under the above-named Package in full conformity with the said Bidding Documents and hereby furnish our Techno-Commercial Proposal.

2.0 We have understood the instructions and the terms & conditions mentioned in the Bidding Documents furnished by you and have thoroughly examined the specifications laid down by you in the Bidding Documents and are fully aware of the nature of consultancy services required.

Attachments to the Bid form (Techno-Commercial Bid):

In line with the requirement of the Bidding Documents we enclose herewith the following Attachments to the Bid Form (Techno-commercial) Bid:

Table 1 : Attachments to the Bid form	
Sr. No	Documents
1	Power of Attorney as per requirement mentioned in NIT.
2	Signed, Stamped and Scanned copy of proof for payment of Earnest Money Deposit (EMD) / MSE Certificate with applicable annexure form for exemption.
3	Signed, Stamped and Scanned copy of Certificates like Registration certificate, GST No, PAN No, PF, etc.

4	Signed, Stamped and Scanned copy of Format for Electronics Payment (Enclosed as Annexure-2 to Forms and Procedures i.e., Section VI)
5	Signed, Stamped and Scanned copy of Tender Acceptance Letter (Enclosed as Annexure-3 to Forms and Procedures i.e., Section VI)
6	Documents as required in accordance with Qualifying Requirements / Pre-Qualification Criteria (PQC) i.e., <u>Clause 6</u> of NIT
7	Signed, Stamped and Scanned copy of No deviation Certificate (Enclosed as Annexure-4 to Forms and Procedures i.e., Section VI)
8	Signed, Stamped and Scanned copy of Certificate from CEO/MD/ Legally Authorized Signatory, in the format as enclosed as Annexure-5 to Forms and Procedures i.e., Section VI.
9	Acceptance to Fraud Prevention Policy of HURL, for which the bidder has to submit Signed, Stamped and Scanned copy of Form of Acceptance of Fraud Prevention Policy of HURL. (Enclosed as Annexure-6 to Forms and Procedures i.e., Section VI).
10	Certificate related to Restrictions on procurement from a Bidder of a country which shares a land border with India” i.e. (Enclosed as Annexure-7 to Forms and Procedures i.e., Section VI).
11	Work orders subject to tender for qualification as per Annex – 12 with clearly mentioning Purchase order details relevant to tender based on which PQC can be achieved. Not to be mentioned as “As Attached”/ “mentioned in Bid”/ etc.
12	Declaration of GST (annexure -15) Signed, Stamped and Scanned copy of Declaration of GST (Enclosed as Annexure-15 to Forms and Procedures i.e., Section VI).
13	Signed, Stamped and Scanned copy of Bid Security Declaration Form (Enclosed as Annexure-13 to Forms and Procedures i.e., Section VI).
14	Signed, Stamped and Scanned copy of GCC, SCC & Scope of Work (i.e. Section-V) of tender document.
15	Any Other Document asked for in the Bidding Document

3.0 COMPLIANCE TO THE PROVISIONS OF THE BIDDING DOCUMENTS

3.1 We have read all the provisions of the Bidding Documents and confirm that notwithstanding anything stated elsewhere in our bid to the contrary, the provisions of the Bidding Documents, are acceptable to us and we further confirm that we have not taken any deviation to the provisions of the Bidding Documents anywhere in our bid.

We have furnished our compliance to the provisions of the Bidding Documents and its subsequent Amendment(s)/Clarification(s)/Addenda/Errata by furnishing “NO DEVIATION CERTIFICATE”.

We hereby confirm that any deviation, variation or additional condition etc. or any mention, contrary to the provisions of Bidding Documents and its subsequent Amendment(s)/Clarification(s)/Addenda/Errata (if any) found anywhere in our bid proposal, implicit or explicit shall stand unconditionally withdrawn, without any cost implication whatsoever to the Owner, failing which our bid security shall be forfeited.

3.2 We further declare that additional conditions, variations, deviations, if any, found in the bid, shall not be given effect to.

3.3 We further declare that we have read and understood all sections (I to VI) of the tender document, endorse all the sections and submitting the bids.

4.0 We undertake, if our bid is accepted, to commence the work immediately upon your Notification of Award to us.

5.0 We agree to abide by this bid for a **period 180 days** from the date of opening of Techno-Commercial bids as stipulated in the Bidding Documents and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.

6.0 Until a formal Contract Agreement is prepared and executed between us, the bids, together with your written acceptance thereof in the form of your Notification of Award shall constitute a binding contract between us.

7.0 We understand that you are not bound to accept our bid or any other bid you may receive.

8.0 We, hereby, declare that only the persons or firms interested in this proposal as principals are named here and that no other persons or firms other than those mentioned herein have any interest in this proposal or in the Contract to be entered into, if the award is made on us, that this proposal is made without any connection with any other person, firm or party likewise submitting a proposal, is in all respects for and in good faith, without collusion or fraud.

9.0 We do hereby declare that our Firm has not been blacklisted/ debarred by any Govt. Department/Public sector undertaking.

10.0 We certify that all information furnished by the our Firm is true & correct and in the event that the information is found to be incorrect/untrue or found violated, then your department/ organization shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

11.0 We hereby declare that we have completed Annexure-12 - Tender Qualification form and provided clear details of the purchase order number and ATO information for verification and evaluation of the prequalification criteria. We acknowledge that failure to provide the mentioned details may lead to the rejection of our bid, and we understand that no claims will be entertained in such a case.

Dated this. ____ day of

Thanking you,

Yours faithfully,

Date :

Place : ____

(authorised signatory Name).

(Designation)

Company Seal

Format For Electronics Payment

Bidders are required to submit the following details on the company's letter head for online transfer of amount to their account:

1.	Contractor Name / Company Name	
	Address:	
	Phone No.	
	E-mail ID	
2. a	Name of the Bank	
b.	Address of the Branch	
c.	Telephone No.	
d.	9 Digit Code number of the Bank and Branch appearing on the MICR Cheque issued by the Bank	
e.	11 Digit NEFT/IFSC Code of the Bank Branch	
f.	Account Type (SB/CC/CA)	
g.	Bank Account No.(as appearing on the Cheque)	
h.	Permanent Account Number (PAN) Under Income Tax Act.	
I	GST Registration Number	
j.	Name of Authorized Signatory	
k.	Contact Person Name	

Attach Cancelled cheque as supporting to Annexure -2

We hereby declare that the particulars given above are correct and complete

Authorized signatory of the bidder

Name

Designation

Date

**TENDER ACCEPTANCE LETTER
(To be given on Company Letter Head)**

Date:

To,

Sub: Acceptance of Terms & Conditions of Tender.

Tender Reference No:

Name of Tender / Work: -

Dear Sir,

1. I/ We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from the web site(s) namely:
as per your advertisement, given in the above-mentioned website(s).
2. I / We hereby certify that I / we have read the entire terms and conditions of the tender documents from Page No. to (including all documents like annexure(s), schedule(s), etc .), which form part of the contract agreement and I / we shall abide hereby by the terms / conditions / clauses contained therein.
3. The corrigendum(s) issued from time to time by your department/ organization too have also been taken into consideration, while submitting this acceptance letter.
4. I / We hereby unconditionally accept the tender conditions of above-mentioned tender document(s) / corrigendum(s) in its totality / entirety.
5. I / We do hereby declare that our Firm has not been blacklisted/ debarred by any Govt. Department/Public sector undertaking.
6. I / We certify that all information furnished by the our Firm is true & correct and in the event that the information is found to be incorrect/untrue or found violated, then your department/ organization shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,
(Signature of the Bidder, with Official Seal)

DECLARATION FOR “NO DEVIATION”**(To be submitted on the Letter Head of the Bidder duly signed by Authorised Signatory)**

1. With reference to our Bid Proposal No. dated For ...(Name of Package to be mentioned)....., we hereby confirm that we comply with all terms, conditions and specifications of the Bidding Documents read in conjunction with Amendments(s) / Clarification(s) / Addenda / Errata (if any) issued by the Owner prior to opening of Techno – Commercial Bids and the same has been taken into consideration while making our Techno – Commercial Bid & Financial Bid and we declare that we have not taken any deviation / exceptions in this regard.

2. We further confirm that any deviation variation or additional conditions etc. or any mention, contrary to the Bidding Documents and its Amendments(s) / Clarification(s) / Addenda / Errata (if any) as mentioned at 1.0 above found anywhere in our Techno – Commercial Bid and / or Financial Bid, implicit or explicit, shall stand unconditionally withdrawn, without any cost implication whatsoever to the Owner, failing which the Bid Security shall be forfeited.

Yours faithfully,

(Signature)

Date:
Designation.....

Name &

Place:
the Company.....

Name of

(Seal of Company)

PROFORMA OF CERTIFICATE
(TO BE SUBMITTED BY CEO/MD/ LEGALLY AUTHORISED SIGNATORY OF THE BIDDING
COMPANY ON COMPANY'S LETTER HEAD IN ORIGINAL)

Ref.

: Date:

To

Manager (C&M),
HURL Admin Building Office,
Hindustan Urvarak & Rasayan Limited, Barauni,
(A JV of CIL, NTPC, IOCL, FCIL & HFCL)
P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.
Sub:

Bidding Doc. No.

Dear Sir,

I, Mr. (CEO of the company / MD of the company/ Authorized Signatory),
hereby certify that the data and documents furnished by M/s..... in respect
of Techno-Commercial Evaluation are true and correct including the contents thereof.

I further, confirm that if at any point of time the declarations given in bid are found to be incorrect,
HURL shall have the full right to terminate the contract and take any action as per provisions of
contract including forfeiture of EMD/Security Deposit.

Yours faithfully,
(Signature)

Date Name & Designation.....
Place Name of the Company.....
(Seal of Company)

(FORM OF ACCEPTANCE OF FRAUD PREVENTION POLICY OF HURL)

(To be submitted on the Letter Head of the Bidder duly signed by Authorised Signatory)

Ref. :

Date:

To
Manager (C&M),
HURL Admin Building Office,
Hindustan Urvarak & Rasayan Limited, Barauni,
(A JV of CIL, NTPC, IOCL, FCIL & HFCL)
P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.

Sub: **FORM OF ACCEPTANCE OF FRAUD PREVENTION POLICY OF HURL**

Bidding Doc. No.

We have read the contents of the Fraud Prevention Policy of HURL displayed on its website <http://www.hurl.net.in> and undertake that we shall strictly abide by the provisions of the said Fraud Prevention Policy of HURL.

Date : (Signature of Authorized Signatory)

Place : (Printed Name)

(Designation).....

(Company Seal)

Model Certificate For Tenders For Works involving possibility of sub-contracting
(TO BE SUBMITTED BY AUTHORISED SIGNATORY OF THE BIDDING COMPANY ON BIDDERS
LETTER HEAD IN ORIGINAL)

Bid Ref No. :

Bidder's Name and Address:

To,
Manager (C&M),
HURL Admin Building Office,
Hindustan Urvarak & Rasayan Limited, Barauni,
(A JV of CIL, NTPC, IOCL, FCIL & HFCL)
P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.

Dear Sir,

We have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries as per the guidelines dated 23.07.2020 & 24.07.2020 issued by Department of Expenditure (DOE), Ministry of Finance; We hereby certify that we/our collaborator/ JV partner/ Consortium member/ Assignee is not from such a country and are eligible to be considered. We further certify that we will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. We hereby certify that we fulfill all the requirements in this regard.

Yours faithfully,

(Signature)

Date

Place

Name & Designation.....

Name of the Company.....

(Seal of Company)

Note: - Bidders not furnishing this aforesaid declaration shall be considered to be from such Countries.

Bid Security Form**Bank Guarantee**

(To be stamped in accordance with Stamp Act,
if any, of the Country of the issuing Bank)

Bank Guarantee No...

Date...

To:

Manager (C&M),
HURL Admin Building Office,
Hindustan Urvarak & Rasayan Limited, Barauni,
(A JV of CIL, NTPC, IOCL, FCIL & HFCL)
P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.
Dear Sirs,

In accordance with Invitation for Bids under your Bid Document No....., M/s having its Registered / Head Office at.....(hereinafter called the 'Bidder') wish to participate in the said bid for [Name of Package] ...

As an irrevocable bank guarantee against Bid Security for an amount of

(*) . valid for..... days from ..(**).... required to be submitted by the Bidder as a condition precedent for participation in the said bid which amount is liable to be forfeited on the happening of any contingencies mentioned in the Bidding Documents.

We, the ... [Name & address of the Bank] ...having our Head Office at ... (#) ... gurantee and undertake to pay immediately on demand by..... .[Name of the Owner] (hereinafter called the Owner)... . the amount of ..(*)without any reservation, protest, demand and recourse. Any such demand made by the 'Owner' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Bidder.

This Guarantee shall be irrevocable and shall remain valid upto(@).....

If any further extension of this guarantee is required, the same shall be extended to such required period (not exceeding one year) on receiving instructions from M/s [Bidder's Name] on whose behalf this guarantee is issued.

Notwithstanding anything contained herein:

1. Our liability under this bank guarantee shall not exceed [Bid security amount]
2. This bank guarantee shall be valid up to [expiry date]

3. We are liable to pay the guaranteed amount or any part under this bank guarantee only and only if you serve upon us a written claim or demand on or before [claim expiry date of guarantee]”.

In witness where of the Bank, through its authorised officer, has set its hand and stamp on this.....day of.....at.....

(Signature)
(Name)
(Designation with Bank Stamp)

Authorized Vide Power of Attorney No...

Date...

NOTE:

1. (*) The amount shall be as specified in the Bid Data Sheets.
(**) This shall be the date of opening of Techno-commercial bids.
(#) Complete mailing address of the Head Office of the Bank to be given.
(@) This date shall be forty-five (45) days after the last date of bid validity.
2. The Bank Guarantee shall be from a Bank as per relevant provisions of ITC clause of the Bidding Documents.
3. The Stamp Paper of appropriate value shall be purchased in the name of Bidder/Bank issuing the Guarantee.
4. While getting the Bank Guarantee issued, Bidders are required to ensure compliance to the points mentioned in relevant Form of Bank Guarantee Verification Check List enclosed in Section-VII of bidding document. Further, Bidders are required to fill up this Form and enclose the same with the Bank Guarantee.
5. HURL Bank details required for the purpose of issuance of Bank Guarantee are

Bank: SBI
Current account no 37880422277,
IFSC Code- SBIN0004803.

Performance Security Form

(To be stamped in accordance with Stamp Act if any, of the Country of the Issuing Bank)

Bank Guarantee No.....

Date.....

To,

Manager (C&M),
HURL Admin Building Office,
Hindustan Urvarak & Rasayan Limited, Barauni,
(A JV of CIL, NTPC, IOCL, FCIL & HFCL)
P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.

Dear Sirs,

In consideration of the[*Owner's Name*]..... (hereinafter referred to as the 'Owner' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) having awarded to M/s[*Bidder's Name*]..... with its Registered /Head Office at (hereinafter referred to as the 'Bidder', which expression shall unless repugnant to the context or meaning thereof, include its successors administrators, executors and assigns), a Contract by issue of Owner's Notification of Award No. dated..... and the same having been unequivocally accepted by the Bidder, resulting into a Contract bearing No..... dated valued at for and the Bidder having agreed to provide a Contract Performance Guarantee for the faithful performance of the entire Contract equivalent to(*).....% (..... percent) of the said value of the Contract to the Owner.

We[*Name & Address of the Bank*].....having its Head Office at.....(hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Owner, on demand any and all monies payable by the Bidder to the extent of(*)..... as aforesaid at any time upto(@)..... [*days/month/year*] without any demur, reservation, contest, recourse or protest and/or without any reference to the Bidder. Any such demand made by the Owner on the Bank shall be conclusive and binding notwithstanding any difference between the Owner and the Bidder or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Owner and further agrees that the guarantee herein contained shall be enforceable till ninety (90) days after expiry of its validity.

The Owner shall have the fullest liberty, without affecting in any way the liability of the Bank under this guarantee, from time to time to extend the time for performance of the Contract by the Bidder. The Owner shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Bidder, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Owner

and the Bidder or any other course or remedy or security available to the Owner. The Bank shall not be released of its obligations under these presents by any exercise by the Owner of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Owner or any other indulgence shown by the Owner or by any other matter or thing whatsoever which under law would, but for this provision, have the effect of relieving the Bank.

The Bank also agrees that the Owner at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Bidder and notwithstanding any security or other guarantee that the Owner may have in relation to the Bidder's liabilities.

Notwithstanding anything contained hereinabove our liability under this guarantee is restricted to(*)..... and it shall remain in force upto and including(@)..... and shall be extended from time to time for such period (not exceeding one year), as may be desired by M/s[Bidder's Name]..... on whose behalf this guarantee has been given.

Dated thisday of.....20..... at.....

WITNESS :

..... (Signature).....
(Signature)

.....
(Name) (Name).....

.....
(Official Address) (Designation with Bank Stamp)

Attorney as per Power
of Attorney No.....
Dated.....

Notes : 1. (*) This sum shall be ten percent (10%) of the Contract Price.

(@) This date will be ninety (90) days beyond the completion date for consultancy work as specified in the Contract.

2.The stamp papers of appropriate value shall be purchased in the name of guarantee issuing Bank.

3.While getting the Bank Guarantee issued, the Bidder is required to ensure compliance to the points mentioned in relevant Form of Bank Guarantee Verification Check List. Further, the Bidder is required to fill up this Form and enclose the same with the Bank Guarantee.

4.The Bank Guarantee shall be from any Scheduled / Commercial Bank recognised by Reserve Bank of India.

BANK GUARANTEE VERIFICATION CHECKLIST

1. Bank Guarantee No.
2. Issuing Bank
3. Amount of BG
4. Nature of BG & No. Pages
5. Validity of BG
6. Package Description
7. Party & Contracts Ref.
8. Bank Reference

CHECK LIST

S.No.	Details of Checks	Yes/No
a)	Is the BG on non-judicial stamp paper of appropriate value, as per Stamp Act?	
b)	Whether date, purpose of purchase of stamp paper and name of the purchaser are indicated on the back of stamp paper under the Signature of Stamp vendor? (The date of purchase of stamp paper should be not later than the date of execution of BG and the stamp paper should be purchased either in the name of the executing Bank or the Bidder on whose behalf the BG has been issued).	
c)	In case the BGs from Banks abroad, has the BG been executed on Letter Head of the Bank, whether adhesive Stamp of appropriate value has been affixed thereon.	
d)	Has the executing Officer of BG indicated his name, designation and Power of Attorney No. / Signing Power No. etc. on the BG?	
e)	Is each page of BG duly signed/initiated by executant and whether stamp of Bank is affixed thereon? Whether the last page is signed with full particulars including two witness under seal of Bank as required in the prescribed proforma?	
f)	Does the Bank Guarantees compare	

verbatim with the Proforma prescribed
in the Bid Documents?

g) In case of any changes in contents of text,
whether changes are of minor/clerical nature
(which in no way limits the right of HURL in
any manner)?

h) In case of deviations in text of BG, which materially
affect the right of Owner, whether the changes
have been agreed based on the opinion by
Legal Department or BG is considered acceptable
on the basis of opinion of Law Department already
available on the similar issue.

i) Are the factual details such as Bid
Document No./Specification No. /
NOA / LOA / Contract No., Contract
Price, Percentage of Advance, Amount
of BG and Validity of BG correctly
mentioned in the BG?

j) Whether overwriting / cutting if any on
the BG have been properly authenticated
under signature & seal of executant?

k) Whether the BG has been issued by
a Bank in line with the provisions of
Bidding / Contract Documents?

l) In case BG has been issued by a Bank
other than Scheduled / Commercial Bank
recognised by Reserve Bank of India,
is the BG confirmed by a Bank in India
acceptable as per Bidding /
Contract Documents?

Date : Signature.....

Place :

Printed Name of Authorized Person having Power of Attorney.

(Designation)

(Common Seal)

Note : The Bidder is required to fill up this form and enclose along with the Bank guarantee.

FORMAT OF CONTRACT AGREEMENT

(To be executed on non-judicial stamp paper of appropriate value)

THIS CONTRACT AGREEMENT is made the _____ day of _____, 20____.

BETWEEN

(1) *[Name of Owner]*, a corporation incorporated under the laws of *[country of Owner]* and having its principal place of business at *[address of Owner]* (hereinafter called "the Owner"), and (2) *[name of Contractor]*, a corporation incorporated under the laws of *[country of Contractor]* and having its principal place of business at *[address of Contractor]* (hereinafter called "the Contractor")

WHEREAS the Owner desires to engage the Contractor to*[scope of work]*..... and the Contractor have agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

ARTICLE 1. CONTRACT DOCUMENTS

1.1 The following documents shall constitute the Contract between the Owner and the Contractor,
and each shall be read and construed as an integral part of the Contract:

- a) This Contract Agreement and the Appendices hereto
- b) Letter of Award .. Ref. No
- c) Amendment to the NIT document.
- d) Instruction to Bidders
- e) Special Conditions of Contract
- f) General Conditions of Contract
- g) Technical Specifications and Drawings
- (f)The Bid and Price Schedules submitted by the Bidder

1.2 Order of Precedence

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1(Contract Documents) above.

1.3 Definitions

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions of Contract.

ARTICLE 2. CONTRACT PRICE AND PAYMENT TERMS

2.1 Contract Price

The Owner hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of: *[amount of foreign currency in words], [amount in figures], and [amount of local currency in words], [amount in figures]*, or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.2 Payment Terms

Payment shall be made by the Owner to the Contractor as per the provisions of Bidding Documents.

ARTICLE 3. EFFECTIVE DATE FOR DETERMINING TIME FOR COMPLETION

The Completion period of the Project shall be determined from the date of Letter of Award.

ARTICLE 4. NON-ASSIGNABILITY

The Contract and benefits and obligations thereof shall be strictly personal to the CONTRACTOR and shall not on any account be assignable or transferable by the CONTRACTOR.

ARTICLE 5. GOVERNMENT OF INDIA NOT LIABLE

It is expressly understood and agreed by and between the Contractor and the Owner that the Owner is entering into this Agreement solely on its own behalf and not on behalf of any other person or entity. In particular it is expressly understood and agreed that the Government of India is not a party to this Agreement and has no liabilities, obligations or rights hereunder. It is expressly understood and agreed that the Owner is an Independent legal entity with power and authority to enter into contracts solely on its own behalf under the applicable laws of India and the general principles of Contract Law. The Contractor expressly agrees, acknowledges and understands that the Owner is not an Agent, Representative or Delegate of the Govt. of India. It is Further understood and agreed that the Government of India is not and shall not be liable for any acts, omissions, commissions, breaches or other wrongs arising out of the Contract. Accordingly, the Contractor expressly waives, releases and foregoes any and all actions or claims, including cross claims, imp leader claims or counter claims against the Government of India arising out of this Contract and covenants not to sue the Government of India as to any manner, claim, cause of action or thing whatsoever arising of or under this Contract.

ARTICLE 6. Appendices

The Appendices listed in the attached list of Appendices shall be deemed to form an integral part of this Contract Agreement. Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

ARTICLE 7. NO LIABILITY ON DIRECTOR AND EMPLOYEE

No Director, employee, consultant or agent of the OWNER or other person representing the OWNER or acting on behalf of the OWNER in or pursuant to the Contract or in the discharge of any obligation to the OWNER under the Contract or otherwise in relation to the Contract shall have any personal liability to the CONTRACTOR or any Sub-Contractor, agent, representative, director or employee of the CONTRACTOR or to any other person acting for or on behalf of the CONTRACTOR and the CONTRACTOR on its own behalf and on behalf of its Sub Contractors, directors, employees, agents and representatives hereby waives and disclaims any and all right of

action which it or they may have whether under tort or Contract or otherwise against the OWNER or any director, employee, agent, consultant or representative of the OWNER for act of omission or commission done or omitted to be done.

ARTICLE 8. WAIVER

No failure or delay by the OWNER in enforcing any right or remedy of the OWNER in terms of the CONTRACT or any obligation or liability of the CONTRACTOR in terms thereof, shall be deemed to be a waiver of such right, remedy, obligation or liability, as the case may be, by the OWNER and notwithstanding such failure or delay, the OWNER shall be entitled at any time to enforce such right, remedy, obligation or liability, as the case may be.

ARTICLE 9. LANGUAGE OF CONTRACT AND COMMUNICATION

The language of the Contract shall be English and all communications, drawings, design, data, information, codes specifications and other document whatsoever supporting the bid or otherwise exchanged under the Contract shall be in English. In the event that any technical documentation is in any language other than English, the document should be translated and presented to the OWNER/Project Manager in English and English document/translated document shall be regarded as the only authentic document.

IN WITNESS WHEREOF the Owner and the Bidder have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by for and on behalf of the Owner

[Signature]

[Title]

in the presence of

Signed by for and on behalf of the Bidder

[Signature]

[Title]

in the presence of _____

CONTRACT AGREEMENT

dated the _____ day of _____, 20_____

BETWEEN

["the Owner"]

and

["the Bidder"]

TENDER QUALIFICATION FORM

(MUST BE FILLED)

THE TENDER SHALL NOT BE EVALUATED IF THE FORM IS NOT FILLED. UDIN AND PURCHASE ORDER DETAILS SHOULD BE CLEARLY MENTIONED. ONLY ORDERS MENTIONED IN THE FORM SHALL BE EVALUATED AND OTHER ORDERS MAY NOT BE EVALUATED EVEN IF THEY ARE ATTACHED. HURL RESERVES THE RIGHT TO REJECT THE BID IF THIS FORM IS NOT FILLED.

To,

HURL Barauni, Begusarai, Bihar – 851115

Tender No. :

Bidder's Name :

In order to meet the PQC and qualification criteria of the subject tender, we submit the below supporting documents:

In order to meet the PQC of above tender No, we submit below supporting documents:					
Details of Annual Turnover (ATO)		FY	UDIN No.		Turn over (INR)
Annual Turnover during		2019-20			
Annual Turnover during		2020-21			
Annual Turnover during		2021-22			
Annual Turnover during		2022-23			
Average ATO for the Preceding 3 Financial Years					
Sl.	Description of items	PO No.	PO Date	PO value in INR	Actual Supplied value in INR
1					
2					
3					
4					
5					
6					
7					

8					
9					
10					

VERY IMPORTANT:

Note to Annexure -12:

1. Bidders shall clearly mention the details in above table in line with the supporting documents and any vague reply like “attached” / “as per supporting” etc. written in above **form such bids shall be liable to reject**. NO CLAIMS SHALL BE ENTERTAINED IF THE DATA IS NOT FILLED PROPERLY AS MENTIONED IN ANNEXURE -12.
2. Bidders must submit all requisite documents mentioned above in support of their meeting the PQC requirement.
3. **Bidders can submit a maximum of 10 Purchase orders with their completion certificates** and the details of the same should be clearly mentioned in the annexure -12. The bidder shall be obligated to furnish an amended copy of the work order in the event that the executed value specified in the completion certificate surpasses the original order value. Failure to comply with this requirement shall grant HURL the right to disqualify the order, and no claims shall be entertained with respect to such occurrences.
4. No work order copies other than mentioned above will be accepted for PQC, technical and financial evaluation at the stage of tender evaluation and shortfall query/clarification. HURL Reserves the right to reject the bid if the document
5. The shortfall shall only be raised for the attached orders. If the bidders fail to attach the purchase orders even after filling out the data in Annexure-12, HURL reserves the right to reject them, and no shortfall may be raised for such instances. Additionally, no claims from the bidders shall be entertained in such cases.
6. Bidders will be given only one opportunity with a fixed deadline to submit any shortfall documents/clarification mentioned in Annexure-12 related to work order/purchase order (if required).

Yours Faithfully,

(Signature of the Bidder with Official Seal)

Bid Security Declaration Form**(On Bidders Letter Head)**

To,
 Manager (C&M),
 HURL Admin Building Office,
 Hindustan Urvarak & Rasayan Limited, Barauni,
 (A JV of CIL, NTPC, IOCL, FCIL & HFCL)
 P.O: Barauni, Distt: Begusarai (Bihar), Pin: 851115.

Sub: Bid Security Declaration Form

Tender Reference No: -

Name of Tender/Work: -

Dear Sir,

I/We. The undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Bid Securing Declaration.
2. I/We accept that I/We may be disqualified from bidding for any contract with you for a period of one year from the date of notification if I am /We are in a breach of any obligation under the bid conditions, because I/We:
 - a. have withdrawn/modified/amended, impairs or derogates from the tender, my/our Bid during the period of bid validity specified in the form of Bid; or
 - b. Having been notified of the acceptance of our Bid by the purchaser during the period of Bid Validity (i) fail or reuse to execute the contract, if required, or (ii) fail or refuse to furnish the Performance Security, in accordance with the Instructions to Bidders.
3. I/We understand this Bid Securing Declaration shall cease to be valid if I am/we are not the successful Bidder, upon the earlier of (i) if I am/ we are not the successful bidder, the receipt of your notification of the name of the successful Bidder; or (ii) thirty days after the expiration of the validity of my/our Bid or any extension thereof.

Signed:

(Insert signature of person whose name and capacity are shown)

in the capacity of

(Insert legal capacity of person signing the Bid Securing Declaration)

Name:

(Insert complete name of person signing the Bid Securing Declaration)

Dated onday of(Insert date of signing)

Corporate Seal (where appropriate)

Note: To Be signed by person who is legally authorised as assigned in Power of Attorney. In case of a Joint venture, the Bid securing declaration must be in the name of all partners to the joint venture that submits the bid.

Self-Certification under Preference to “MAKE IN INDIA” Policy

CERTIFICATE

In line with Government Public Procurement Order No. P-45021/2/2017-BE-II dt. 15.06.2017, as amended from time to time and as applicable on the date of submission of tender, we hereby certify that we M/s_____ (supplier name) are local supplier meeting the requirement of minimum Local content (50%) as defined in above orders for the material against Tender

No_____

Details of location at which local value addition will be made is as follows:

We also understand, false declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rule for which for which a bidder or its successors can be debarred for up two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law. Seal and Signature of Authorized Signatory.

Seal and Signature of Authorized Signatory

DECLARATION OF GST NON-ENROLMENT

Dear Sir/Madam,

Sub: Declaration of non-requirement of registration under the Central/State/UT/Integrated Goods and Services Tax Act, 2017

I/We..... (Name of the service provider/business entity), do hereby declare that I/we am/are not registered under the Goods and Services Tax Act, 2017 as (select and fill below for the relevant reason)

-I/We deal in/supply the category of goods or services (Describe the nature of the services/goods) which are exempted under the Goods and Service Tax Act, 2017.

-I/We have the annual aggregate turnover below the taxable limit as specified under the Goods and Services Tax Act, 2017.

-I/We are yet to register ourselves under the Goods and Services Tax Act, 2017.

I/We hereby also confirm that if anytime during any financial year I/we decide or require or become liable to register under the GST, I/we undertake to provide all the requisite documents and information.

I/We request you to consider this communication as a declaration for not requiring to be registered under the Goods and Service Tax Act, 2017.

I/We hereby also confirm that (Name of the service recipient) shall not be liable for any loss accrued to me/us, due to any registration default with the GST.

Signature of Authorised Signatory:

Name of the Authorised Signatory:

Name of Business:

Date:

Stamp/Seal of the business entity:

**DECLARATION REGARDING GST
(To be given on Company Letter Head)**

Date:

To,

Sub: Declaration Regarding GST

Tender Reference No:

Name of Tender / Work: -

Dear Sir,

We hereby submit following declaration with respect to the applicability of GST.

☐ GST (Goods and Service Tax) on transportation activity being under reverse charge mechanism (RCM) shall be deposited by HURL.

☐ GST shall be Charged by the bidder @ _____% will be reimbursed by HURL.

(Please tick in the applicable Box for GST)

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

Note: -

If the bidder quotes Zero "0" in the Applicable GST rate in the declaration OR doesn't submit the declaration then the GST amount would be deemed to be included in the per unit rate quoted by the bidder in the BOQ.

PROFORMA OF "NO DEMAND CERTIFICATE" BY CONTRACTOR
(TO BE ISSUED BY THE CONTRACTOR)

NAME OF PACKAGE:

NAME OF CONTRACTOR:

LETTER OF AWARD/ NOA/ CONTRACT NO.:

DATED:

We, M/s (Contractor) do hereby acknowledge and confirm that we have received the full and final payment due and payable to us from HURL (Owner) in respect of our aforesaid LOA/ NOA/ Contract No..... dated including amendments, if any, issued by HURL, to our entire satisfaction and we further confirm that we have no claim whatsoever pending with HURL under the said Contract.

Notwithstanding any protest recorded by us in any correspondence, document, measurement books, and/or final bills etc., we waive all our rights to lodge any claim or protest in future under this contract.

We are issuing this "NO DEMAND CERTIFICATE" in favour of HURL with full knowledge and with our free consent without any undue influence, misrepresentation, coercion, duress, etc.

Date

Signature

Place

Name

Designation

(Company Common Seal)

(This certificate shall be accompanied by the Power of attorney of the signatory)