SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)

Enquiry No. & Date: 61Q2300055 Date 27.05.2022

निविदा आमंत्रण सूचना

NOTICE INVITING TENDER

Sir/Madam,

Bharat Heavy Electricals Limited (hereinafter referred to as **BHEL**) is a Central Public Sector Enterprise, having its Branch office at Transmission Business Group, 10TH Floor, Plot no.:- C-20, 1A/1, Joy towers,C Block, Phase 2, Industrial Area, Sector-62, Noida, Distt. Gautambudh Nagar, UP-201301, invites offer in sealed cover under two part bid system (Part-I: Techno commercial Part & Part-II: Price Part) from the competent agencies for **"Pre-bid tie-up for supply & services of 220kV GIS at Sabzi Mandi (New Delhi) for addressing tender invited by DTL for 220kV GIS at Sabzi Mandi , New Delhi.** Please submit your competitive offer for the above subject work as per the tender terms & conditions.

SCHEDULE TO TENDER

1.	*Tender Reference No.*	**61Q2300055 Date 27.05.2022**
2.	*Date of Issue of Tender:*	***28.05.2022***
3.	*Type of Tender:*	*Open Tender*
4.	*Tender Title:*	**"Pre-bid tie-up for supply & services of 220kV GIS at Sabzi Mandi (New Delhi) for addressing tender invited by DTL for 220kV GIS at Sabzi Mandi, New Delhi"** **Technical Specification No. TB-PBTU-DTL-SBJM-GIS**
5.	*Tender issuing Authority*	*Transmission Business Group, 10TH Floor, Plot no.:- C-20, 1A/1, Joy towers,C Block, Phase 2, Industrial Area, Sector-62, Noida, Distt. Gautambudh Nagar, UP-201301*
6.	*Last date/ time for receipt of tender:*	***04.06.2022 by 11.00 Hrs***
7.	*Date/ time of opening of (Part-I):*	***04.06.2022 at 16.00 Hrs***
8.	*Offer/Bid submission mode*	*Tender is invited through e-Procurement System only. The bidder shall submit their bid through e-Procurement platform at* ***https://eprocurebhel.co.in****.*
9.	*Tender will be opened at:*	*BHEL TBG– HQ Noida of above mentioned address at point no. 5.*
10.	*Date/Time of price bid opening:*	*Will be intimated separately to the Techno-commercially qualified bidders in due course of time.*
Note:- For other instructions; bidder may please refer the Terms & Conditions and Special terms & conditions		

All corrigenda, addenda, amendments, Bid Submission extension, clarifications, etc. to the tender will be hosted on website **http://www.bhel.com** and **https://eprocurebhel.co.in** only. Bidders should regularly visit website till the due date of submission to keep themselves updated. Any clarification(s) regarding Notice Inviting Tender (NIT), if required, should be sought before the tender due date from the officials as mentioned in the tender Document.

Thanking you,

For & on behalf of

Bharat Heavy Electricals Ltd.

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

BHEL NIT
Terms and conditions

Project: Tender for Pre-Bid Tie-up for Supply & Services of 220 kV Gas Insulated Switchgear (GIS) for addressing tender invited by DTL for 220 kV Sub-station at Sabzi Mandi, New Delhi.
Specification No. TB-PBTU-DTL-SBJM-GIS

Tender due date: 04.06.2022

PREAMBLE

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

- Bharat Heavy Electricals Limited (BHEL) (A Government of India Enterprise) incorporated under the Companies Act, 1956, having its Registered office at BHEL House, Siri Fort, New Delhi intends to participate in the tender, invited by **M/s DTL for 220 kV GIS Package for Design, Engineering, Supply, Erection, Testing & Commissioning of 220kV GIS Sub-Station with complete civil works & automation at Sabzi Mandi on Turnkey Basis.**

- Due date of Tender enquiry for BHEL to submit the bid to DTL is 14.06.2022.

- BHEL comply the qualification criteria as EPC bidder (As per Route-4 of the QR of M/s DTL) and can submit the bid with the support of a GIS Manufacturer only. Accordingly, for complying the tender requirement in totality and to address this tender opportunity, a qualified GIS manufacturer is required to be explored for project specific pre bid tie-up.

- For addressing the above tender, BHEL wish to have a tender specific pre bid tie-up with **220kV GIS Manufacturer who meets the Qualification requirement as outlined in this tender documents (Technical specification).**

- BHEL, therefore, invites sealed bids from eligible bidders for this project as per terms & conditions specified in the tender documents.

- The GIS manufacturer must meet the techno-commercial Qualification requirement as stipulated in technical specification and any subsequent amendment.

- The qualified, lowest evaluated Bidder having requisite capacity and capability to perform the contract for the aforesaid tender as per the provisions of the Bidding Documents shall be pre-selected, for the scope of work contained in the Bidding Documents, for associating with BHEL for addressing the tender invited by M/s DTL.

- GIS OEM/bidders will have to furnish Performance Bank guarantee as per clause no. 15 to 17 of STC.

- BHEL will assess the technical and financial capability of the bidder (s) as per the qualifying requirement mentioned in the tender documents and will reserve the right to accept/ reject the party.

- The Owner (M/s DTL / BHEL reserves the right to request for any additional information at any stage as per their qualifying requirement. If in the opinion of the BHEL, the details furnished by the bidder (s) are incomplete, their price bid shall not be opened.

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

- The pre-selected party associating with BHEL shall not be allowed to participate as a bidding company directly; or indirectly through their Subsidiaries, Partnership, Ownership, Individual firm; or through any other route. The party shall submit an undertaking in this respect.

- Each Party shall use all reasonable efforts to secure the award of the Contract. No Party shall, however, have a claim against any other Party arising out of a failure to secure a Contract for the Project except as a result of material breach of this Agreement.

- In case BHEL becomes successful Bidder and receives the LOA from M/s DTL, a firm Purchase Order shall be placed to the successful GIS Manufacturer/bidder for execution of relevant scope of work contained in this Bidding Documents.

- The project specific MOU will be signed between BHEL & selected GIS manufacturer for final submission of the bid by BHEL to M/s DTL.

- In the event of price reduction during negotiation by BHEL with the customer (M/s DTL), corresponding reduction will be passed on to the supplier (s) "shall be incorporated in tender

- BHEL reserves the right to cancel/withdraw this invitation for bids without assigning any reason and shall bear no liability whatsoever consequent upon such a decision.

- For tender Qualification apart from documents towards technical experience requirement, following documents shall be sought from the GIS manufacturer along with their bid:
    - i) Consent letter from the proposed GIS manufacturer (on their letter head) for entering into pre-bid tie up with BHEL-TBG.
    - ii) A legally enforceable undertaking (jointly with GIS manufacturer) to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s).
    - iii) A confirmation letter from the GIS manufacturer/ GIS Collaborator/ Parent/ Subsidiary/JVC/ Group/sister concern company etc. as applicable that they shall furnish performance guarantee to end customer M/s DTL for an amount of 10 % of the ex-works cost (quoted by BHEL to DTL) of such equipment(s).

- The GIS manufacturer must not be Banned or Delisted or Black Listed by any Government Department / Public Sector Undertaking on due date of submission of bid. The bidder will give a written confirmation in this regard along with the bid.
- **Bidders may please note that the bids obtained shall be opened in-camera. The reverse auction is not applicable for this tender.**

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

SPECIAL TERMS & CONDITIONS

1. In case any discrepancy between the requirements mentioned under special terms & conditions and general terms & conditions, special terms and conditions shall prevail.

2. For any technical clarification, kindly contact **Ms. Sobhna Singh, Sr. Manager (TBEM)**
   BHEL, Transmission Business Group
   9Th Floor, Plot No: C-20/1/A-1, Joy Towers, Sector-62, Noida-201309, UP, India
   Phone: +91 (0) 0120- 6748514
   Fax: +91 (0) 0120 – 6748580.
   E-mail: shobhna@bhel.in

3. For any commercial clarification, kindly contact **Mr. Sandeep Kumar, Dy.Manager (TBMM);**
   BHEL, Transmission Business Group
   10Th Floor, Plot No: C-20/1/A-1, Joy Towers, Sector-62, Noida-201309, UP, India
   Phone: +91 (0) 0120- 6748450
   Fax: +91 (0) 0120 – 6748580.
   E-mail: kumar.sandeep@bhel.in

4. **Bidder to submit offer directly to TENDER BOX (Address mentioned below) or email to tbmmtenderbox@bhel.in** for part-1 bid (i.e., techno-commercial bid) & **tbmmtender.pricebidbox@bhel.in** for Part-2 (i.e. PRICE BID) or **through NIC portal** (https://eprocurebhel.co.in/nicgep/app). No other mode for submission of tender is acceptable. Address is

   TENDER BOX
   BHEL, TRANSMISSION BUSINESS GROUP
   10th FLOOR, C-20/1A/1, JOY TOWERS,
   SECTOR-62, NOIDA-201309, UP, INDIA

   Offer submission due date and time: 04.06.2022, 11:00 AM

   Offer opening due date and time: 04.06.2022, 16:00 PM

5. **PROPOSED DELIVERY PLAN**: ***Supply of GIS within 16 Months from the date of placement of purchase order & subsequent supervision during E&C. Vendor to examine*** their best possible delivery plan & mention in **ACTIVITY SCHEDULE.** The same shall be submitted in BHEL format along with commercial offer duly signed and stamped by authorized person. In case, BHEL's

delivery requirement is not met by vendor(s), then a chance may be given to all such vendors to review their quoted delivery schedule in line with BHEL's delivery requirement.

6. **Permissible Technical & Commercial Deviations:** No permissible technical & commercial deviation has been envisaged. Bidder to strictly follow the same, else offer is liable for rejection.

7. **Type of tender:** This tender is open tender but not a global tender and only **CLASS-I** suppliers as defined under the DPIIT order no. P-45021/2/2017-PP (BE-II) dated 16.09.2021 **are eligible to bid in this tender**. **Bids received from CLASS-II & Non-Local supplier shall be rejected**. Please refer clause mentioned at **Annexure-1** and Certification at **Annexure-2 / Annexure-3** (whichever is applicable) regarding restrictions under Rule 144 (xi) of General Financial Rules (GFRs), 2017. Bidder to comply with the clause and submit the certification. Non-compliance/ Non-submission of certification will lead to rejection of Offer.

8. **Mandatory tender documents:** Bidder shall submit the following documents along with commercial offer. Bidder to strictly follow the same else offer is liable for rejection.

   - **Compliance of General Financial Rules (GFRs): Annexure-2 or 3** (whichever is applicable).
   - **Local content certificate:** Format is enclosed in **Annexure-A.** Bidder must fill the local content in percentage.
   - **Bidders may please be noted that the minimum local Content in line with PPP-MII order, order ref no.:- A-1/2021-FSC-Part (5) dated 16.11.2021 issued by Govt of India, Ministry of Power for the item GIS is 60%. The bidder has to declare this local content in Annexure-A.**
   - **The Bidder's declaration in Annexure-A for Local content Less than 60% shall not be considered as Class-I supplier and their bid shall be rejected.**

   - **MoP (ministry of Power) compliance:** Bidder to comply the MOP circular dated 02-07-2020 and its subsequent amendment, if any, in prescribed format (**Annexure-B**). Non-compliance/ Non-submission will lead to rejection of Offer.
   - **Integrity pact:** Format is enclosed in **Annexure-C.**

9. **Quantity Variation**: The final quantity may vary at contract stage by **± 20%** of total contract value.

10. **PRE-QUALIFYING REQUIREMENT**: Bidder must comply the following, else the offer is liable for rejection.

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

- Technical PQR, which is mentioned in BHEL's technical specification. GIS OEM/bidder to ensure submission of qualification documents as stipulated in Technical PQR along with the bid itself.

Note:

(1). Bidder must submit all supporting documents along with their offer. No deviation against this enquiry is acceptable, else offer shall be rejected.

(2). All documents (including third party documents/supporting documents) in language other than English, certified translated copy in English language should also be furnished.

(3) Offers will be scrutinized based on the qualifying requirements and only those who are technically and financially capable to execute the job and who fulfil the prequalifying requirements (PQR) are eligible to quote against above NIT. However, final acceptance of the bidder/offer shall be subject to acceptance of our customer.

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

11. IMPORTANT INSTRUCTION TO BIDDER – I;

a. **PRE-BID MEETING:** NOT ALLOWED.

b. **SUBMISSION OF MANUFACTURER AUTHORIZATION FORMAT, INTEGRITY PACT AND DECLARATION OF LOCAL CONTENT:** Bidder to submit undertaking letter in their letterhead by declaring that these documents shall be submitted within 3 days after opening of price bid in case of L1 position. Bidder to indicate percentage of local content in their undertaking letter.

c. **OPENING OF BIDS (PART-I & II):** Bidders are not authorized to attend the opening of Part-I & Part-II bid for this tender.

d. **PROJECT STATUS:** Domestic in nature & GST is applicable for supply & services

e. **CUSTOMER APPROVAL: The GIS manufacturer/bidder must meet the techno-commercial Qualification requirement as stipulated in technical specification and any subsequent amendment.**

The GIS manufacturer/bidder must not be Banned or Delisted or Black Listed by any Government Department / Public Sector Undertaking on due date of submission of bid. The bidder will give a written confirmation in this regard along with the bid.

f. **PLACEMENT OF ORDER:** This tender is for tender specific pre bid tie-up only. The Purchase Order shall be placed to the successful GIS Manufacturer/bidder for execution of relevant scope of work contained in this Bidding Documents only if BHEL receives the order from the end customer (DTL), which shall be done within 75 DAYS from the date of award by DTL.

Tender evaluation shall be done based on overall quantity as per NIT, **however PO/LOI shall be placed on L1 bidder at ex-works value for main GIS supply and services & separate PO/LOI for mandatory spares and separate PO/LOI for maintenance equipment & tools & tackles shall be placed (as applicable).** Total cost for this purpose shall include cost of scope of work as mentioned in NIT along with applicable taxes & duties, and other services etc. (if applicable). GST input credit available to BHEL shall be reduced from prices while determining L1 status.

Price breakup **including mandatory spares**, if any, required during execution of project shall be done only for account purpose and must be supported by logical relationship with original quoted prices.

g. **INLAND FREIGHT & INSURANCE:** Supplier must ensure availability of their authorized person at site/store during for supervision of unloading for every LOT of dispatch. The Freight & Insurance to be paid by vendor on behalf of BHEL to be reimbursed. Proof of transit insurance should be submitted along with dispatch documents.

Note: Transit Insurance policy shall be in Bidder's scope and that should also have a provision of 30 days extended cover at site/ store. **Place of site/store is Sabzi Mandi, New Delhi, INDIA.**

h. **MQP Requirement**: As per specification.

i. **GeM ID seller:** GeM seller ID is mandatory for the bidders and must be mentioned in their offer. In case at the time of submission of offer GeM seller ID is not available with bidder, then successful tenderer should ensure to have GeM Seller ID prior to award of contract. Department of Expenditure (DOE) OM no. 6/9/2020-PPD dated 24.08.2020 may be referred in this regard.

12. IMPORTANT INSTRUCTION TO BIDDER - II;

a. For detail description of BOQ item please refer BOQs attached in technical specification TB-PBTU-DTL-SBJM-GIS.

b. Packing as per specification is applicable. However, bidder to ensure proper packing to avoid any damage & packing of spares should be separated.

c. Validity of PERFORMANCE BG: It should cover the defect liability period & additional cover period of 3 months for claim.

d. BHEL /Customer or both may witness the inspection as per approved QAP.

e. The unit prices of addition/ deletion (.i.e. optional items) and type test charges (if applicable), as mentioned in BOQ of section-1 of technical specification shall be considered for evaluation.

f. Order shall be awarded on ex- works basis for indigenous bidder.

g. Unloading of material at site is not in scope of bidder.

h. Validity of offer: 9 MONTHS **from the date of OPENING of offer** i.e. opening date of techno-commercial bid (Part-I).

13. DEFECT LIABILITY/GUARANTEE CLAUSE:

Detail terms & condition shall be as per Clause no. 05 of BHEL/TBG/GTC/2016 Rev.01, however, Defect liability/Guarantee period shall be five years from the date of Operational Acceptance of the facilities (or any part thereof) or 18 Months from the last date of supplies whichever period concludes later.

14. Liquidated Damage for Supply (Clause no. 13 of BHEL/TBG/GTC/2016 Rev.01): In case of delay in execution of Purchase Order beyond the contractual delivery time, an amount of 0.5% of the total PO Ex-Works value & F & I Charges for supply per week of delay or part thereof subject to a maximum of 10% of the total PO Ex-Works value & F & I Charges shall be deducted as Liquidated Damages (LD) along with applicable GST (if any) on LD.

SPECIAL TERMS & CONDITIONS

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15. **Clause No 07 of GTC (PERFORMANCE BG): Option-B (10% of total ex-works value) is applicable.** However, PERFORMANCE BG will be valid up to 90 days beyond the defect liability period/ Guaranty period. Bidder (Qualified L1 bidder) shall arrange to submit Performance BG / deposit on a non-judicial stamp paper of appropriate value along with first invoice or within 60 days from placement of Purchase Order (PO) whichever is earlier.

16. Bidder agrees to submit performance BG required for execution of the contract within the time period mentioned. In case of delay in submission of performance security, enhanced performance security which would include interest (SBI rate + 6%) for the delayed period, shall be submitted by the bidder. Further, if performance security is not submitted till such time the first bill becomes due, the amount of performance security due shall be recovered as per terms and conditions defined in NIT / Contract, from the bills along with due interest."

17. **ADDITIONAL BG**: The successful bidder, to whom the work is awarded (subject to the receiving the order from End customer M/s DTL) , shall be required to furnish additional Performance Guarantee of Ten (10) % of the ex-works cost of GIS order value of customer contract within Twenty-Eight (28) days after receipt of the Letter of award from BHEL, in the form of Bank Guarantee from a scheduled Commercial bank (the List of the advised Banks is enclosed in the tender Document). Validity of this additional BG will cover the defect liability/ Guarantee/warranty period with 03 months claim period extra.

18. **SECURITY/ BID BOND**: Within 30 days of the signing the MOU, 1% of the value of MOU shall be taken from the supplier as "Bid Bond" in the form of Bank Guarantee or security deposit etc. till the submission of the performance Bank Guarantee (PBG). For registered GIS supplier, Bid Bond shall not be applicable. After receipt of the PBG and additional BG, the BID Bond shall be returned to the MOU Partner.

19. **PRICE BID FORMAT:**
    Bidder to quote their best prices strictly in BHEL's prescribed format of NIT, else their offer shall be liable to be rejected. Bidder has to mention "quoted" (in each applicable cell) in UN-PRICED BID. In case that cell is Not Applicable, "NA" must be mentioned in that particular cell. Prices shall be mentioned in Price bid schedule only. In case during detailed engineering stage, it is found that Item mentioned with "NA" is to be supplied, bidder shall supply the same without any cost and delivery implication to BHEL.

20. **Clause No. 2.1 of general Terms & Conditions for tender Enquiry / Contract should be as follows:**

    PRICES: A. Prices shall be FIRM. No enhancement of rate for whatsoever reasons unless and until asked by BHEL shall be allowed.

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

PROJECT STATUS: Domestic in nature. GST is applicable as per prevalent law.

21. TERMS OF PAYMENT:

(i) clause no 3.1 to 3.5 - of GTC are not applicable in this NIT

(ii) Following modified clause shall be applicable in place of existing clause no 3.2,3.5 of GTC;

3.2 For Supply where Supervision of Erection, Testing & Commissioning (ETC) at Site is in scope of the supplier or Supply where Testing & Commissioning at Site is in scope of the supplier

TERMS OF PAYMENT FOR INDIGENOUS BIDDER:

A. 85% of ex-works along with 100% value of GST & 100% F & I Charges payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows:

- LR / GR duly endorsed by BHEL Site Official.
- Material Receipt Certificate issued by BHEL Site Official.
- GST Compliant Tax Invoice
- Packing List (Case-wise)
- Copy of Transit Insurance Certificate from underwriters.
- Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management
- Guarantee Certificate
- Copy of Performance Bank Guarantee (PBG)
- Certificate of acceptance of Type Test Reports issued by BHEL Engineering management wherever specifically mentioned in the Purchase Order.

B: 10% of ex-works value payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows:

- Invoice.
- Original certificate of successful completion of Supervision of Erection, Testing including HV Testing & Commissioning at Site issued by BHEL Site Official / Construction Management.

Note: In case of Supervision of Erection, Testing including HV Testing & Commissioning gets delayed beyond 12 months from the date of last supply for the reasons not attributable to supplier, supplier may claim payment of only five (05) % of supply portion by furnishing following documents and balance five (5) % of supply portion will be released after completion of successful completion of Supervision of Erection, Testing including HV Testing & Commissioning at Site issued by BHEL Site Official / Construction Management as mentioned above clause no-21.B of STC.

a) Invoice

b) Copy of certificate issued by BHEL site in charge. Confirming that delay in Supervision of Erection, Testing including HV Testing & Commissioning is not attributable to supplier (to be arranged by BHEL TBG)

c) Copy of Bank Guarantee of equivalent value initially valid for 6 months from the date of submission of invoice with additional claim period of three months. Incase Supervision of Erection, Testing including HV Testing & Commissioning is not successfully completed before expiry of Bank Guarantee, BG shall be kept suitably extended till successful completion of Supervision of Erection, Testing including HV Testing & Commissioning.

C.: 5% of ex-works value payment of total invoice value against completion of final engineering documentation as per technical specification and completion of supervision activity within 60 days from date of receipt of invoice. Documents (original + 2 copies) will be required for payment.

- Invoice.
- Final engineering documentation certificate by BHEL Engg group
- Copy of valid Performance BG.

3.5 For Charges for Supervision of Erection, Testing & Commissioning at Site:

100% payment along with applicable GST within 60 days from the date of receipt of complete GST compliant Tax invoice along with certificate of successful completion of Supervision of Erection, Testing including HV test & Commissioning at Site issued by BHEL Site Official / Construction Management in 3 sets (Original + 2 copies).

22. MODE OF PAYMENT: The following clause shall be applicable in place of clause no 41 of general terms and conditions

(1) Payment shall be made directly to the supplier/contractor by BHEL through NEFT/RTGS.

23. Promotion of MAKE IN INDIA:

For this procurement, the local content to categorize a supplier as class-I local supplier / class- II local supplier / non-Local supplier and purchase preference to class I local supplier, is as defined in Public Procurement (Preference to Make in India), Order 2017 dated 04.06.2020, issued by DPIIT. In case of subsequent orders issued by the nodal ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT but before opening of part II bids against this NIT. **Note: Bidder to specify the percentage of local content as per the format as per Annexure-A**

24. INTEGRITY PACT: INTEGRITY PACT (Refer clause no - 34 of GTC):

Bidders shall have to enter into Integrity Pact with BHEL, duly signed with seal in original, if specified in NIT / RFQ failing which bidder's offer shall be liable for rejection.

(a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner.

Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

Sl	IEM	Email
1	Shri Arun Chandra Verma, IPS (Retd.)	acverma1@gmail.com
2	Shri Virendra Bahadur Singh, IPS (Retd.)	vbsinghips@gmail.com

(b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

(c) Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

Note:

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below:

(1)
Name: Mr. Sandeep Kumar
Deptt: TBMM
Address: BHEL Noida
Phone: 0120 674 8450
Email: kumar.sandeep@bhel.in

(2)
Name: Mr. Nandlal Verma
Deptt: TBMM
Address: BHEL Noida
Phone: 0120 674 8477
Email: nverma@bhel.in

25. REVERSE AUCTION (Clause No. 33 of GTC for Reverse Auction): NOT APPLICABLE

26. INDEMNITY (AGAINST PATENTS / TRADEMARKS ETC):

The vendor shall at all times indemnify the purchaser against all claims which may be made in respect of supply from any "rights protected" source protected by way of patent registration of design or trade mark. In the event of any claim in respect of an alleged breach of patents

registered design or trademark being made against the purchaser, purchaser shall notify the seller of the same and the seller shall be at liberty, but entirely at their own expenses, to conduct negotiation for settlement or deal with any litigation that may arise there from.

27. INVOLVEMENT OF REPRESENTATIVE:

Bidder must be GIS manufacturer. Purchase Orders will be placed on successful bidder directly for total supplies and services subject to prior approval by BHEL/end Customer.

In a tender, either the Indian agent on behalf of the Principal/OEM or Principal/OEM itself can submit bid but both cannot submit bid simultaneously for the same item/product in the same tender.

If an agent submits bid on behalf of the Principal/OEM, the same agent shall not submit a bid on behalf of another Principal/OEM in the same tender for the same item/product.

28. ADDITIONAL /EXTRA ITEM REQUIRED AT SITE DUE TO DAMAGE REPORTED AT SITE/ THEFT FOR COMPLETION OF PROJECT:

In case of additional requirement of any item specified in BOQ, whether due to damages / theft or any other reason, during contract (i.e., till expiry of contract i.e., end of guarantee period), contractor shall ensure supply of same at unit Price mentioned in purchase order main BOQ (supply and service portion) or BOQ for addition /deletion (if any).

29. ARBITRATION (Clause No. 19 of BHEL/TBG/GTC/2016 Rev.01): This clause shall be read as per **Annexure-D.**

30. HEALTH, SAFETY AND ENVIRONMENT (HSE) OF BHEL: BHEL has their own Health, safety and environment. HSE policy is enclosed for bidder's reference.

31. Following confirmation to be provided by vendor:

"We confirm that we have quoted as per specified price format provided along with this tender".

Note: BHEL reserves the right to cancel this enquiry at any point of time. Bids of only customer approved vendors will be processed.

NAME & SEAL OF TENDERER

SPECIAL TERMS & CONDITIONS

NAME OF PROJECT: - PRE BID TIE UP FOR SUPPLY & SERVICES FOR DTL'S 220KV GIS SUBSTATION AT SABZI MANDI (NEW DELHI)
Enquiry No. 61Q2300055 & Date: 27.05.2022

Enclosures:

a) Activity Schedule, Commercial & Technical deviation Sheet.
b) Instruction of DPIIT (**Annexure-1), Annexure-2 / 3** (Compliance regarding restrictions under Rule 144 (xi) of General Financial Rules (GFRs), 2017).
c) Format for declaration of minimum local content (**Annexure-A**).
d) Format for compliance of MoP order dated 02-07-2020 (**Annexure-B**).
e) Format of Integrity pact (**Annexure-C**).
f) Arbitration clause (**Annexure-D**).
g) Details of Packing list of GIS Module (**Annexure-E**).
h) Consent letter from GIS manufacturer (**Annexure-D2**).
i) Pro-forma for joint undertaking
j) Format of additional Performance BG.
k) Copy of HSE policy.
l) GENERAL TERMS AND CONDITION OF NIT.
m) BHEL'S PRICE BID FORMAT.
n) All required documents/ credentials meeting BHEL's Technical PQR shall be submitted by GIS OEM/bidder.
o) Technical Specification and PQR

ACTIVITY SCHEDULE

(EACH MFC/LOTS)

PROJECT :
ENQUIRY NO :

SN	ACTIVITY	TIME ALLOTED [in weeks]	CUMULATIVE TIME FROM RECEIPT OF INPUTS FROM BHEL [in weeks]	SCOPE
1.	Inputs to vendor from BHEL after issue of PO (Last inputs).	4		IN SCOPE OF BHEL
2.	Submission of Documents necessary for getting manufacturing clearance.			IN SCOPE OF SUPPLIER
3.	Review and Approval of documents from BHEL/Customer and issue of manufacturing clearance lot wise as defined.	6		IN SCOPE OF BHEL
4.	Manufacturing time for individual lots.			IN SCOPE OF SUPPLIER
5.	Inspection call			IN SCOPE OF SUPPLIER
6.	Inspection by BHEL/Customer	2		IN SCOPE OF BHEL
7.	Issue of Dispatch clearance	2		IN SCOPE OF BHEL
8.	Dispatch			IN SCOPE OF SUPPLIER
9.	Supervision of ETC works			AS PER REQUIRMENT AT SITE

1. Inspection call should be raised two (02) weeks in advance. Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.
2. Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier. Bidder to submit revised drawing and documents incorporating comments, if any, within two (02) weeks from the date of comments of BHEL/Customer.
3. **Delay in activity pertaining to BHEL not attributable to vendor as listed above shall be added, if required in case of time extension and will be re-fixed accordingly based on bidder's request & delay analysis.**

Signature & Seal of Supplier
Date:

ANNEXURE-1

CLAUSES FOR NEW TENDERS:

I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.

II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not failing in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.

III. "Bidder from a country which shares a land border with India" for the purpose of this Order means:

   a. An entity Incorporated, established or registered in such a country; or
   b. A subsidiary of an entity Incorporated, established or registered in such a country; or
   c. An entity substantially controlled through entitles incorporated, established or registered in such a country; or
   d. An entity whose *beneficial owner* is situated in such a country, or
   e. An Indian (or other) agent of such an entity; or
   f. A natural person who is a citizen of such a country; or
   g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The *beneficial owner* for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.
   Explanation-
      a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent. of shares or capital or profits of the company;
      b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholder's agreements or voting agreements;
2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;
3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of Individuals;
4. Where no natural person is Identified under (1) or (2) or (3) above the beneficial owner is the relevant natural person who holds the position of senior managing official;
5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another or to represent another in dealings with third person.

VI. The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority.

* The above clause is not applicable to the bidders from those countries (even if sharing a land border with India) to which the GoI has extended lines of credit or in which the GoI is engaged in development projects.

* List of countries to which lines of credit have been extended or in which development projects are undertaken are available on the Ministry of External affairs website (https://www.mea.gov.in/)

Annexure-2

Compliance to be submitted in INR 100/- non judicial stamp paper

Sub: **Compliance to Government of India order OM No.6/18/2019-PPD dated 23.07.2020 regarding restrictions under Rule 144 (XI) of the General Financial Rules (GFRs), 2017**

Sl No.	**Description**	**Bidder's confirmation**
1	*We, M/s_____have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; We hereby certify that we are not from such a country.*	*Agreed*

(Note: Non-compliance of above said GoI Order and its subsequent amendment, (if any), by any bidder(s) shall lead for commercial rejection of their bids by BHEL)

Bidder's authorized signatory with stamp & seal

Annexure-3

Compliance to be submitted in INR 100/- non judicial stamp paper

Sub: **Compliance to Government of India order OM No.6/18/2019-PPD dated 23.07.2020 regarding restrictions under Rule 144 (XI) of the General Financial Rules (GFRs), 2017**

S.N.	Description	Bidder's confirmation
1	*We, M/s_____have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India. We are from such a country which shares a land border with India & have been registered with the Competent Authority as specified in above said order. We hereby certify that we fulfil all requirements in this regard and are eligible to be considered.* ***Evidence of valid registration by the Competent Authority is attached.***	*Agreed*

(Note: Non-compliance of above said GoI Order and its subsequent amendment, (if any), by any bidder(s) shall lead for commercial rejection of their bids by BHEL)

Bidder's authorized signatory with stamp & seal

Annexure-A

Enquiry No. :	
Project :	
Type of project	**Transmission ~~/ Thermal (Coal or Gas) / Hydro~~**
Applicable percentage of Local Content	**Bidder to indicate local content in percentage**

Certificate from statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of Local Content, in line with PPP-MII order, if applicable *[to be submitted on the letter head of the issuer.]*

Dear Sir,

We have read and understood the provisions of "Public Procurement (Preference to Make in India) Order, 2017" dated 15/06/2017, its revision dated 28/05/2018 and any subsequent modifications/Amendments, if any [hereinafter, "PPP-MII Order"] issued by Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, Government of India.

In line with the provisions of the PPP-MII Order, M/s. ……*[Enter the name of the Bidder] [*hereinafter, "Local Supplier"*]* have submitted an Affidavit of self-certification to M/s. Bharat Heavy Electricals Limited [hereinafter, BHEL] regarding Local Content in Goods/Services/Works to be supplied by the Local Supplier for …… *(Enter the name of the Equipment/Item for Project).]*, wherein they have agreed to abide by the terms and conditions of the PPP-MII Order.

Further, in line with the PPP-MII Order, the statutory auditor or cost auditor of the company (in the case of companies) or a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) shall provide a certificate giving the percentage of Local Content in the Goods/Service/Works to be supplied by the Local Supplier for …… *(Enter the name of the Equipment/Item for Project).*

Accordingly, we, the Statutory Auditor(s) / Cost auditor (*applicable in the case of companies*) of the Local Supplier / a practicing cost accountant or practicing chartered accountant (*applicable in respect of suppliers other than companies*), certify that the Local Content as defined under the PPP-MII, in the Goods/Service/Works to be supplied by the Local Supplier for …… *(Enter the name of the Equipment/Item for Project).* is …….. percentage [*specify the percentage of Local content*].

For and on behalf of, Date:

Authorised persons

Firm Reg No:
Membership No.

Note: This is a guiding format. In case the bidder submits the certificate in a format different from the above, the same may be considered provided it meets the intent and purpose, as may be ascertained by BHEL.

Annexure-B

Vendor Compliance format in bidder letter head

In view of by order No. 25-111612018-PG, Dated 02.07.2020 of Ministry of Power, GOI

Enquiry No/ PO No & Date :
Project :
Name of items/Package :

This is to certify that all equipment, components, and parts imported for use in the Power Supply System and Network are in strict compliance to directions issued by Ministry of Power, Govt. of India vide order No. 25-111612018-PG dated 02.07.2020. The imported component(s), part or assembly item(s) does not carry any malware/Trojan etc.

Note: Non-compliance of MoP Order and its subsequent amendment(s), (if any), by vendor shall lead to rejection of their offer or cancellation of contract, which is awarded by BHEL.

Bidder's authorized signatory

with stamp & seal

Annexure-1

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____ (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint panel of Independent External Monitor(s) (IEMs), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. The Bidder(s)/ Contractor(s) commits himself to observe the following principles during participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process , terminate the contract, if already awarded, exclude from future business dealings and/ or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal is entitled to terminate the Contract according to Section 3, or terminates the Contract in application of Section 3 above , the Bidder(s)/ Cotractor (s) transgression through a violation of Section 2 above shall be construed breach of contract and the Principal shall be-entitled to demand and recover from the Contractor an amount equal to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee , whichever is higher, as damages, in addition to and without prejudice to its right to demand and recover compensation for any other loss or damages specified elsewhere in the contract.

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 6 - Equal treatment of all Bidder (s)/ Contractor (s) / Sub-contractor (s)

6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.

6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.

6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 -Independent External Monitor(s)

8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.

8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.

8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.

8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Prinicpal should be looked into by the CVO of the Principal.

8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.

8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.

8.13 The word `Monitor' would include both singular and plural.

Section 9 - Pact Duration

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.

10.2 Changes and supplements as well as termination notices need to be made in writing.

10.3 If the Bidder(s)/ Contractor(s) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.

10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

Sandeep

For & On behalf of the Principal
(Office Seal)

Place Noida
Date 27.12.2022

Witness:
(Name & Address) Noida

For & On behalf of the Bidder/ Contractor
(Office Seal)

Witness:
(Name & Address)

Annexure-2

Clause on IP in the tender

"Integrity Pact (IP)

(a) IP is a tool to ensure that activities and transactions between the Company and its Bidders/ Contractors are handled in a fair, transparent and corruption free manner. Following Independent External Monitors (IEMs) on the present panel have been appointed by BHEL with the approval of CVC to oversee implementation of IP in BHEL.

Sl	IEM	Email
1.	Shri Arun Chandra Verma, IPS (Retd.)	acverma1@gmail.com
2.	Shri Virendra Bahadur Singh, IPS (Retd.)	vbsinghips@gmail.com

(b) The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory) along with techno-commercial bid (Part-I, in case of two/ three part bid). Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

(c) Please refer Section-8 of IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to any of the above IEM(s). All correspondence with the IEMs shall be done through email only.

Note:

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing (procurement) department's officials whose contact details are provided below:

Details of contact person(s):

(1)
Name: Sandeep
Deptt: Material Management
Address: Noida
Phone: (Landline/ Mobile) 0120-674-8458
Email: kumarsandeep@bhel.in
Fax:

(2)
Name: Nand Lal Verma
Deptt: Material Management
Address: Noida
Phone: (Landline/ Mobile) 0120674-8477
Email: nverma@bhel.in
Fax:

CLAUSE NO. 19 OF GTC: ARBITRATION CLAUSE SHALL BE READ AS BELOW:

(A) CONCILIATION (MODEL CONCILIATION CLAUSE FOR CONDUCTING CONCILIATION PROCEEDINGS UNDER THE BHEL CONCILIATION SCHEME, 2018)

The Parties agree that if at any time (whether before, during or after the arbitral or judicial proceedings), any Disputes (which term shall mean and include any dispute, difference, question or disagreement arising in connection with construction, meaning, operation, effect, interpretation or breach of the agreement, contract or the Memorandum of Understanding (whichever is inapplicable), which the Parties are unable to settle mutually), arise inter-se the Parties, the same may, be referred by either party to Conciliation to be conducted through Independent Experts Committee to be appointed by competent authority of BHEL from the BHEL Panel of Conciliators.

Notes:

1. No serving or a retired employee of BHEL/Administrative Ministry of BHEL shall be included in the BHEL Panel of Conciliators.

2. Any other person(s) can be appointed as Conciliator(s) who is/are mutually agreeable to both the parties from outside the BHEL Panel of Conciliators.

The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in **Annexure-A to this GCC (Enclosed).**

The Annexure-A together with it's appendices will be treated as if the same is part and parcel hereof and shall be as effectual as if set out herein in these GCC."

(B) ARBITRATION (WITH SOLE ARBITRATOR)

1.1. Except as provided elsewhere in this Contract, in case amicable settlement is not reached between the Parties, in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract, then, either Party may, by a notice in writing to the other Party refer such dispute or difference to the Sole Arbitrator and such Arbitrator appointed by Head of the BHEL Unit/Region/Division issuing the Contract.

1.2. The Arbitrator shall pass a reasoned award and the award of the Arbitrator shall be final and binding upon the Parties.

1.3. Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) and amended in 2015 and further amendment passed in 2019 or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be New Delhi. The language of arbitration shall be English and the documents shall be submitted in English.

1.4. The cost of arbitration shall initially be borne equally by the Parties subject to the final apportionment of the cost of the arbitration in the award of the Arbitrator.

1.5. Notwithstanding the existence or any dispute or differences and/or reference for the arbitration, the Contractor shall proceed with and continue without hindrance the performance of its

CLAUSE NO. 19 OF GTC: ARBITRATION CLAUSE SHALL BE READ AS BELOW:

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obligations under this Contract with due diligence and expedition in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

1.6. **SETTLEMENT OF COMMERCIAL DISPUTES BETWEEN CPSES INTER SE AND CPSE(S) AND GOVERNMENT DEPARTMENT(S)/ ORGANISATION(S) – ADMINISTRATIVE MECHANISM FOR RESOLUTION OF CPSES DISPUTES (AMRCD) – REGARDING**

Vide Dept. of Public Enterprises OM No. F. No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22.05.2018 it has been conveyed that *"To make the mechanism more effective and binding on the disputing parties, a new mechanism namely Administrative Mechanism for resolution of CPSEs Disputes (AMRCD) having two level (tier) structure has been evolved in consultation with various stakeholders to replace the existing PMA mechanism which stands wound up from the date of issue of this OM."* Accordingly, the existing Permanent Machinery of Arbitration (PMA) stands wound up with effect from 22.05.2018 and cases relating to disputes or differences relating to the interpretation and application of the provisions of commercial contract(s) between CPSEs / Port Trust / Central or State Government Department / Organisations (excluding disputes concerning Railways, Income Tax, Customs and Excise Departments) shall be taken up by either party for its resolution through Administrative Mechanism for Resolution of CPSEs Disputes (AMRCD).

(C) JURISDICTION AND GOVERNING LAWS

The Courts at New Delhi shall have exclusive jurisdiction over any matter arising out of or in connection with this Contract. This Contract shall be construed as per and be governed by the Laws of India.

ANNEXURE TO MODEL CONCILIATION CLAUSE FOR CONDUCT OF CONCILIATION UNDER THE BHEL CONCILIATION SCHEME, 2018

BRIEF PROCEDURE FOR CONDUCT OF CONCILIATION PROCEEDINGS

1. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided herein:

2. The party desirous of resorting to Conciliation shall send an invitation/notice in writing to the other party to conciliate specifying all points of Disputes with details of the amount claimed. The party concerned shall not raise any new issue thereafter. Parties shall also not claim any interest on claims/counter-claims from the date of notice invoking Conciliation till the conclusion of the Conciliation proceedings.

3. The party receiving the invitation/notice for Conciliation shall within 30 days of receipt of the notice of Conciliation intimate its consent for Conciliation along with its counter-claims, if any.

4. The Conciliation in a matter involving claim or counter-claim (whichever is higher) up to Rs 5 crores shall be carried out by sole Conciliator nominated by BHEL while in a matter involving claim or counter-claim (whichever is higher) of more than Rs 5 crores Conciliation shall be carried out by 3 Conciliators nominated by BHEL.

5. The Parties shall be represented by only their duly authorized in-house executives/officers and neither Party shall be represented by a Lawyer.

6. The first meeting of the IEC shall be convened by the IEC by sending appropriate communication/notice to both the parties as soon as possible but not later than 30 days from the date of his/their appointment. The hearings in the Conciliation proceeding shall ordinarily be concluded within two (2) months and, in exceptional cases where parties have expressed willingness to settle the matter or there exists possibility of settlement in the matter, the proceedings may be extended by the IEC by a maximum of further 2 months with the consent of the Parties subject to cogent reasons being recorded in writing.

7. The IEC shall thereafter formulate recommendations for settlement of the Disputes supported by reasons at the earliest but in any case within

15 days from the date of conclusion of the last hearing. The recommendations so formulated along with the reasons shall be furnished by the IEC to both the Parties at the earliest but in any case within 1 month from the date of conclusion of the last hearing.

8. Response/modifications/suggestions of the Parties on the recommendations of the IEC are to be submitted to the IEC within time limit stipulated by the IEC but not more than 15 days from the date of receipt of the recommendations from the IEC.

9. In the event, upon consideration, further review of the recommendations is considered necessary, whether by BHEL or by the other Party, then, the matter can be remitted back to the IEC with request to reconsider the same in light of the issues projected by either/both the Parties and to submit its recommendations thereon within the following 15 days from the date of remitting of the case by either of the Parties.

10. Upon the recommendations by the Parties, with or without modifications, as considered necessary, the IEC shall be called upon to draw up the Draft Settlement Agreement in terms of the recommendations.

11. When a consensus can be arrived at between the parties only in regard to any one or some of the issues referred for Conciliation the draft Settlement Agreement shall be accordingly formulated in regard to the said Issue(s), and the said Settlement Agreement, if signed, by the parties, shall be valid only for the said issues. As regards the balance issues not settled, the parties may seek to resolve them further as per terms and conditions provided in the contract.

12. In case no settlement can be reached between the parties, the IEC shall by a written declaration, pronounce that the Conciliation between the parties has failed and is accordingly terminated.

13. Unless the Conciliation proceedings are terminated in terms of para 22 (b), (c) & (d) herein below, the IEC shall forward his/its recommendations as to possible terms of settlement within one (1) month from the date of last hearing. The date of first hearing of Conciliation shall be the starting date for calculating the period of 2 months.

14. In case of 3 members IEC, 2 members of IEC present will constitute a valid quorum for IEC and meeting can take place to proceed in the matter after seeking consent from the member who is not available. If necessary, videoconferencing may be arranged for facilitating participation of the members. However, the IEC recommendations will be signed by all members. Where there is more than one (1) Conciliator, as a general rule they shall act jointly. In the event of differences between the Members of IEC, the decision/recommendations of the majority of the Members of IEC shall prevail and be construed as the recommendation of the IEC.

15. The Draft Settlement Agreement prepared by the IEC in terms of the consensus arrived at during the Conciliation proceedings between the Parties shall be given by the IEC to both the parties for putting up for approval of their respective Competent Authority.

16. Before submitting the draft settlement agreement to BHEL's Competent Authority viz. the Board Level Committee on Alternative Dispute Resolution (BLCADR) for approval, concurrence of the other party's Competent Authority to the draft settlement agreement shall be obtained by the other party and informed to BHEL within 15 days of receipt of the final draft settlement agreement by it. Upon approval by the Competent Authority, the Settlement Agreement would thereafter be signed by the authorized representatives of both the Parties and authenticated by the members of the IEC.

17. In case the Draft Settlement Agreement is rejected by the Competent Authority of BHEL or the other Party, the Conciliation proceedings would stand terminated.

18. A Settlement Agreement shall contain a statement to the effect that each of the person(s) signing thereto (i) is fully authorized by the respective Party(ies) he/she represents, (ii) has fully understood the contents of the same and (iii) is signing on the same out of complete freewill and consent, without any pressure, undue influence.

19. The Settlement Agreement shall thereafter have the same legal status and effect as an arbitration award on agreed terms on the substance of the dispute rendered by an arbitral tribunal passed under section 30 of the Arbitration and Conciliation Act, 1996.

20. Acceptance of the Draft Settlement Agreement/recommendations of the Conciliator and/or signing of the Settlement Agreement by BHEL shall

however, be subject to withdrawal/closure of any arbitral and/or judicial proceedings initiated by the concerned Party in regard to such settled issues.

21. Unless otherwise provided for in the agreement, contract or the Memorandum of Understanding, as the case may be, in the event of likelihood of prolonged absence of the Conciliator or any member of IEC, for any reason/incapacity, the Competent Authority/Head of Unit/Division/Region/Business Group of BHEL may substitute the Conciliator or such member at any stage of the proceedings. Upon appointment of the substitute Conciliator(s), such reconstituted IEC may, with the consent of the Parties, proceed with further Conciliation into the matter either de-novo or from the stage already reached by the previous IEC before the substitution.

22. The proceedings of Conciliation under this Scheme may be terminated as follows:
    a. On the date of signing of the Settlement agreement by the Parties; or,
    b. By a written declaration of the IEC, after consultation with the parties, to the effect that further efforts at conciliation are no longer justified, on the date of the declaration; or,
    c. By a written declaration of the Parties addressed to the IEC to the effect that the Conciliation proceedings are terminated, on the date of the declaration; or,
    d. By a written declaration of a Party to the other Party and the IEC, if appointed, to the effect that the Conciliation proceedings are terminated, on the date of the declaration.
    e. On rejection of the Draft Settlement Agreement by the Competent Authority of BHEL or the other Party.

23. The Conciliator(s) shall be entitled to following fees and facilities:

Sl No	**Particulars**	**Amount**
1	Sitting fees	Each Member shall be paid a Lump Sum fee of Rs 75,000/- for the whole case payable in terms of paragraph No. 27 herein below.
2	Towards drafting of settlement agreement	In cases involving claim and/or counter-claim of up to Rs 5crores. Rs 50,000/- (Sole Conciliator)

Sl No	Particulars	Amount
		In cases involving claim and/or counter-claim of exceeding Rs 5 crores but less than Rs 10 crores. Rs 75,000 (per Conciliator) In cases involving claim and/or counter-claim of more than Rs 10 crores. Rs 1,00,000/- (per Conciliator) Note: The aforesaid fees for the drafting of the Settlement Agreement shall be paid on Signing of the Settlement Agreement after approval of the Competent Authority or Rejection of the proposed Settlement Agreement by the Competent Authority of BHEL.
3	Secretarial expenses	Rs 10,000/- (one time) for the whole case for Conciliation by a Sole Member IEC. Where Conciliation is by multi member Conciliators –Rs 30,000/- (one time)- to be paid to the IEC
4	Travel and transportation and stay at outstation i) Retired Senior Officials of other Public Sector Undertakings (pay scale wise equivalent to or more than E-8 level of BHEL)	As per entitlement of the equivalent officer (pay scale wise) in BHEL.
	Others	As per the extant entitlement of whole time Functional Directors in BHEL.

Sl No	Particulars	Amount
		Ordinarily, the IEC Member(s) would be entitled to travel by air Economy Class.
5	Venue for meeting	Unless otherwise agreed in the agreement, contract or the Memorandum of Understanding, as the case may be, the venue/seat of proceedings shall be the location of the concerned Unit / Division / Region / Business Group of BHEL. Without prejudice to the seat/venue of the Conciliation being at the location of concerned BHEL Unit / Division / Region / Business Group, the IEC after consulting the Parties may decide to hold the proceedings at any other place/venue to facilitate the proceedings. Unless, Parties agree to conduct Conciliation at BHEL premises, the venue is to be arranged by either Party alternately.

24. The parties will bear their own costs including cost of presenting their cases/evidence/witness(es)/expert(s)on their behalf. The parties agree to rely upon documentary evidence in support of their claims and not to bring any oral evidence in IEC proceedings.

25. If any witness(es) or expert(s) is/are, with the consent of the parties, called upon to appear at the instance of the IEC in connection with the matter, then, the costs towards such witness(es)/expert(s) shall be determined by the IEC with the consent of the Parties and the cost so determined shall be borne equally by the Parties.

26. The other expenditures/costs in connection with the Conciliation proceedings as well as the IEC's fees and expenses shall be shared by the Parties equally.

27. Out of the lump sum fees of Rs 75,000/- for Sitting Fees, 50% shall be payable after the first meeting of the IEC and the remaining 50% of the Sitting Fees shall be payable only after termination of the conciliation proceedings in terms of para 22 hereinabove.

28. The travelling, transportation and stay at outstation shall be arranged by concerned Unit as per entitlements as per Serial No. 3 of the Table at para 23 above, and in case such arrangements are not made by the BHEL Unit, the same shall be reimbursed to the IEC on actuals limited to their entitlement as per Serial No. 4 of the Table at Para 23 above against supporting documents. The IEC Member(s) shall submit necessary invoice for claiming the fees/reimbursements.

29. The Parties shall keep confidential all matters relating to the conciliation proceedings. Confidentiality shall extend also to the settlement agreement, except where its disclosure is necessary for purposes of its implementation and enforcement or as required by or under a law or as per directions of a Court/Governmental authority/ regulatory body, as the case may be.

30. The Parties shall not rely upon or introduce as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the Disputes that is the subject of the Conciliation proceedings:
    a. Views expressed or suggestions made by the other party in respect of a possible settlement of the Disputes;
    b. admissions made by the other party in the course of the Conciliator proceedings;
    c. proposals made by the Conciliator;
    d. The fact that the other Party had indicated his willingness to accept a proposal for settlement made by the Conciliator.

31. The Parties shall not present the Conciliator(s) as witness in any Alternative Dispute Resolution or Judicial proceedings in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.

32. None of the Conciliators shall act as an arbitrator or as a representative or counsel of a Party in any arbitral or judicial proceeding in respect of a Disputes that is/was the subject of that particular Conciliation proceeding.

33. The Parties shall not initiate, during the Conciliation proceedings, any arbitral or judicial proceedings in respect of a Disputes that is the subject matter of the Conciliation proceedings except that a Party may initiate arbitral or judicial proceedings where, in his opinion, such proceedings are necessary for preserving his rights including for preventing expiry of period of limitation. Unless terminated as per the provisions of this Scheme, the Conciliation proceedings shall continue

notwithstanding the commencement of the arbitral or judicial proceedings and the arbitral or judicial proceedings shall be primarily for the purpose of preserving rights including preventing expiry of period of limitation.

34. The official language of Conciliation proceedings under this Scheme shall be English unless the Parties agree to some other language.

Format 2 to BHEL Conciliation Scheme, 2018

FORMAT FOR SEEKING CONSENT FOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

M/s. (Stakeholder's name)

Sub: Resolution of the Disputes through conciliation by Independent Expert Committee (IEC).

Ref: Contract No/MoU/Agreement/LOI/LOA& date _____.

Sir,

With reference to above referred Contract/MoU/Agreement/LOI/LOA, you have raised certain Disputes/claims. Vide your letter dated____ you have requested BHEL to refer the Disputes/claims to IEC for Conciliation.

We are enclosing herewith Format (3) for giving consent and the terms and conditions of BHEL Conciliation Scheme, 2018 governing conciliation through IEC. You are requested to give your unconditional consent to the said terms and conditions of the Scheme by returning the same duly sealed and signed on each page. On receipt of your consent, matter will be put to the Competent Authority for consideration and decision.

Please note that BHEL has also certain claims against you (if applicable). BHEL reserves its right to agree or not to agree conciliation of the said disputes through BHEL and this letter is being issued without prejudice to BHEL's rights and contentions available under the contract and law.

Yours faithfully,

Representative of BHEL

Format 3 to BHEL Conciliation Scheme, 2018

FORMAT FOR GIVING CONSENT BY CONTRACTOR/VENDOR/CUSTOMER/COLLABORATOR/CONSORTIUM PARTNERSFOR REFERRING THE DISPUTES TO CONCILIATION THROUGH IEC

To,

BHEL

.....

Sub: Resolution of Disputes through Conciliation by Independent Expert Committee (IEC).

Ref: Contract/MoU/Agreement/LOI/LOA No & date____

With reference to above referred contract, our following bills/invoices/claims submitted to BHEL are still unpaid giving rise to Disputes:

SL. no.	Claim Description	Bill submitted to BHEL (no. and date)	Amount of the bill/claim	Amount received from BHEL	Outstanding Amount

Accordingly we request you to kindly refer the Disputes in respect of above claims to IEC for Conciliation.

We hereby agree and give our unconditional consent to the terms and conditions of BHEL Conciliation Scheme, 2018 governing conciliation through IEC. We have signed the same on each page and enclosed it for your consideration.

Yours faithfully,

(Signature with stamp)

Authorized Representative of Contractor
Name, with designation
Date

Format 5 to BHEL Conciliation Scheme, 2018

STATEMENT OF CLAIMS/COUNTER CLAIMS TO BE SUBMITTED TO THE IEC BY BOTH THE PARTIES

1. Chronology of the Disputes

2. Brief of the Contract/MoU/Agreement/LOI/LOA

3. Brief history of the Disputes:

4. Issues:

5. Details of Clam(s)/Counter Claim(s):

Sl. No.	**Description of claim(s)/Counter Claim**	**Amount (in INR)Or currency applicable in the contract**	**Relevant contract clause**

6. Basis/Ground of claim(s)/counter claim(s) (along with relevant clause of contract)

Note– *The Statement of Claims/Counter Claims may ideally be restricted to maximum limit of 20 pages. Relevant documents may be compiled and submitted along with the statement of Claims/Counter Claims. The statement of Claims/Counter Claims is to be submitted to all IEC members and to the other party by post as well as by email.*

ANNEXURE-E

Project :
Enquiry No :
Name of Package:

DETAILS OF PACKAGES

S. N.	*Discriptions*	*ESTIMATED QUANTITY*
1	NO OF PACKAGES/CASES	
2	SIZE (MAXIMUM & MINIMUM)	
3	WEIGHT	
4	NOS OF COC CONTAINERS (TYPES & QTY), IF ANY	

Note:

1. The above is required only to facilate the store at site.
2. Bidder to submit standard storage instrcution along with offer.

Annexure-D2

CONSENT LETTER FROM GIS MANUFACTURER TO BE FURNISHED BY THE ERECTOR

(To be submitted on the letterhead of the company)

To

Dt. …….

Delhi Transco Ltd.
Shakti Sadan, Kotla Road
New Delhi-110002.

IN RESPECT OF TURNKEY PACKAGE (Name of tender).
TENDER NO. ……..

Dear Sir,

The undersigned on behalf of M/s…….having its manufacturing units at ……. and registered office at…… wish to confirm as under:

1. That, we shall supply GIS equipments to M/s …… meeting the technical specification as specified in Delhi Transco Limited said Tender No ……..

2. That, we as a GIS Manufacturer meet the qualifying criteria as specified in Clause 1.1/1.2/1.3 of Annexure A, BDS, Vol-I of the said Tender No. …….

3. That, we shall supply the GIS equipments in line with the agreed Time Schedule between Delhi Transco Limited and M/S……..

4. That, we shall undertake supervision of erection, testing & commissioning in case of award of contract to M/s……..(To be submitted by an erector who is not having GIS experience as provided in Cl. 1.4)

5. That, documentation in respect of our qualification and experience is enclosed with this consent letter as per the requirement of Tender Specifications.

That, Undersigned is authorized to submit this consent/confirmation letter on behalf of M/s……(Authorization letter enclosed).

For and on behalf of M/s……
Signature:……
Name:…….
Designation:……Seal:……

Annexure-I.A
(on non-judicial stamp paper of Rs.300/-)
MANUFACTURER'S AUTHORIZATION

Ref No._____ Date_____

To,
Gujarat State Electricity Corporation Ltd,
8 th Floor, Sardar Patel Vidyut BHavan,
Race Course,
Vadodara-390007
Gujarat, India.

Dear Sir,
Tender No_____Under (Tender Notice No._____) for supply of _____ (item)

We _____ who are established and reputable manufacturers of _____(name & description of goods offered) having factory at _____(Address of factory) do hereby authorize M/s. _____(name & address of Agent) to submit a bid, and sign the contract with you for the above goods manufactured by us against the above NIT under TN No._____.

We shall extend our full guarantee and warranty as per the General Conditions of Contract appended with specification for goods and services offered for supply by the above firm against this NIT. Further, we hereby confirm as follows:

1. We confirm for design, manufacturing & testing of equipments as per relevant IS/IEC/ANSI with latest amendments.
2. We give commitments for full technical / after sale support including spares during erection, testing and commissioning and confirm that products are as per technical specifications & type tested as per IEC/IS/ specification from accredited laboratory.
3. We also confirm that we are having all the testing facilities as required for testing of the equipment as per relevant IS/TEC/ANSI with their latest amendments.
4. We confirm that this authorization will remain in force at least up to guarantee period of equipments.
5. We confirm for free replacement / repair within the guarantee of equipments.
6. We confirm that all acceptance tests shall be carried out in presence of GSECLs Engineer in any NABL in India / at OEM's works without any extra cost to GSECL.
7. We confirm that, for dispute, if any, the Indian judicial as defined by purchaser shall be binding to us and we shall be abide & act as per Indian govt. rules & regulation in to.

Yours faithfully,
Date : Sign & seal of manufactures

6. PROFORMA OF BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No…… Date …….....

To,

To
[Name and address of the Employer]

1) In consideration of the Delhi Transco Limited (hereinafter called "The Undertaking") having agreed to accept from M/s…….. (hereinafter called the said contractor(s) from the demand, under the terms & conditions of an agreement dated…….. between Delhi Transco Limited& M/s……. for supply of……... Nos.…… in respect of NOA No……. dated……. (hereinafter called the agreement) security deposit for the due fulfillment of the said contract of the terms & conditions contained in the said agreement on production of Bank Guarantee for Rs……..…. (Rupees……..……..). We Name of Bank with address) (hereinafter referred to as "The Bank") do hereby undertake to pay to the undertaking amount not exceeding Rs……(Rupees……) against any loss or damage caused to or suffered or would be caused to the said contractor of any of the terms & conditions in the said agreement. As such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this guarantee. However, our liability under this guarantee shall be restrict to an amount not exceeding Rs…….. (Rupees…….).

2) We (Name of Bank with address) do hereby undertake to pay the amount due and payable under this guarantee without any demur, merely on a demand for the undertaking stating that the amount claimed due by a way of loss or damage caused to or would be caused to suffered by the undertaking by reason of any breach, by the said contractor(s) or any of the terms & conditions contained in the said agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs…… (Rupees…….).

3) We (Name of Bank with address), further agree that the guarantee herein contained shall remain I full force and effect during the period that would be taken for performance of the said agreement and that it shall continue to be enforceable till all the dues of the undertaking by virtue of the said agreement have been fully paid and its claims satisfied or discharged of till (Date of validity) the undertaking certified that the terms & conditions of the said agreement have been fully and properly carried out by the said contractor(s) and accordingly guarantee is made on us in writing on or before the (Date of validity).

4) We (Name of Bank with address), further agree with the undertaking that the undertaking shall have the fullest liberty without our consent and without effecting in any manner our obligations hereunder to vary any of the agreement or to enforce any of the performance by the said contractor and to forebear or enforce any of the terms & conditions relating to the said or any such variation, or extension being warrantee to the said contract(s) for any forbearance, act or omission on the part of the undertaking or any indulgence by the Undertaking to the contractor(s) or by any such matter or thing

whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

5) We, (Name of Bank with address), lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Undertaking in writing and to extend the period of guarantee, if required for any reason.

6) "Notwithstanding anything contained herein above, our liability under this guarantee is restricted to Rs…… (Rupees……..) and the guarantee shall remain in force upto (date of validity) unless a demand or claim in writing is presented on the bank within (date of validity). The Bank shall be relieved and discharged from all liabilities there under"

Dated the…….. Day of …….200

For (Name of Bank)

(BRANCH MANAGER)

WITNESS

1…….

18. PROFORMA OF JOINT UNDERTAKING BY THE COLLABORATOR/ PARENT COMPANY/PRINCIPAL/SISTER CONCERN ALONGWITH THE BIDDER/MANUFACTURER

(On non-judicial stamp paper of appropriate value)

THIS DEED OF UNDERTAKING executed this …… day of Two Thousand and…… by M/s…… a company incorporated under the laws of ……..and having its registered office at……(hereinafter called the "Collaborator/Parent Company/Principal/sister concern" which expression shall include its successors, administrators, executors and permitted assigns) and M/s…..…….a company incorporated under the laws of …….. and having its registered office at…… ……(hereinafter called the "Bidder/Manufacturer" which expression shall include its successors, administrators, executors and permitted assigns) in favour of Delhi Transco Limited, having its Registered office at Shakti Sadan, Kotla Marg, New Delhi.(herein after called the "Employer" which expression shall include its successors, executors and permitted assigns)

WHEREAS the "Employer" invited Bid as per Specification No. …….. for the execution of ……..(Insert name of the Project)…….

AND WHEREAS Clause No. ……, Section ……..,of ……., Vol.-……forming part of the Bidding Documents inter-alia stipulates that the Bidder and/or Manufacturer alongwith its collaborator/parent company/principal/sister concern must fulfill the Qualifying Requirements for the *…….. and be jointly and severally bound and responsible for the successful performance of the *…….offered in the event the bid submitted by the bidder is accepted by the Employer resulting in Contract.

AND WHEREAS the bidder has submitted its bid to the Employer vide Proposal No. ……..dated ……based on the collaboration /association of the collaborator/parent company/principal/sister concern with the Bidder/Manufacturer.

NOW THEREFORE THIS UNDERTAKING WITNESSTH as under.

1.0 In consideration of the award of Contract by the Employer to the Bidder (herein after referred to as the "Contract") we, the collaborator/parent company/principal/sister concern and the Bidder/Contractor and /or manufacturer do hereby declare that we shall be jointly and severally bound unto the DELHI TRANSCO LIMITED , for the guarantee quality, timely supply ,successful performance and warranty obligations of the * …….. and shall be fully responsible for the design, manufacturer , testing, supply on FOR destination delivery at site basis and supervision of unloading at site, storage, erection, testing & commissioning and successful performance of the *…….in accordance with the Contract Specifications.

2.0 Without in any way affecting the generality and total responsibility in terms of deed of Undertaking, the Collaborator in particular hereby agrees to depute their technical experts from time to time to the Bidder/Contractor's/Manufacture's Works/ Owner's project site as mutually considered necessary by the Owner, bidder/Contractor, Manufacturer and the collaborator to ensure proper design, engineering, manufacturer, testing ,supply on for destination delivery at site basis and supervision of unloading at site , storage, erection, testing and commissioning and successful performance of the collaborator shall advise the manufacturer/ contractor suitable modifications of designs and implement necessary corrective measures to discharge the obligations under the contract.

3.0 This deed of undertaking shall be construed and interpreted in accordance with the laws of India and the Courts in Delhi shall have exclusive jurisdiction in all matters arising under the undertaking.

4.0 As a security, the bidder shall apart from the contractor's performance guarantee furnish a contract performance guarantee from its Bank in favour of the Employer on a form acceptable to the Employer. The value of such guarantee shall be equivalent to 10% of price of such equipments manufactured in India as identified in the contract awarded by the Employer to the bidder/contractor and it shall be part of guarantee towards the faithful performance/ compliance of this deed of undertaking in terms of the contract. The guarantee shall be unconditional, irrevocable and valid for the entire period of the contract, namely till the end of the defect liability period of Project under the contract. The bank guarantee amount shall be payable to the Employer on demand without any reservation or demur. This shall be in addition to the contract performance guarantee furnished by the contractor.

5.0 We the collaborator/parent company/principal/sister concern and bidder/contractor and /or manufacturer agree that this undertaking shall be irrevocable and shall from an integral part of the contract and further agree that this undertaking shall continue to be enforceable till the Employer discharges it. It shall become operative from the effective date of contract.

IN WITNESS WHEREOF the collaborator/parent company/principal/sister concern and bidder/contractor and /or manufacturer, have through their Authorized Representatives executed these present and affixed common seals of their respective Companies, on the day, month and year first above mentioned.

WITNESSES:

For Collaborator/parent company/principal/sister concern

1.---------- Signature of Authorized Representative

(Signature)

(Name in Block Letter) Name----------

(Office Address) Common seal of Company ----------

2.---------- Signature of Authorized Representative

(Signature)

(Name in Block Letter) Name----------

(Office Address) Common seal of Company----------
-

For Manufacturer

3.---------- Signature of Authorized Representative

(Signature)

(Name in Block Letter) Name----------

(Office Address) Common seal of Company----------

Note:

(i) This deed of Joint undertaking duly certified by the Company Secretary shall be submitted along with the bid. Further, the deed of Joint Undertaking attested by Notary Public of the place(s) of the respective executants (s) or registered with the Indian Embassy/ High Commission in the country shall be submitted by the bidder before opening of price bid. In case the bidder fails to submit the deed of Joint Undertaking as mentioned above, the bidders bid guarantee may be forfeited.

(ii) In the event the bidder is a Manufacturer and the collaboration is between collaborator and the Bidder, then the Joint deed of Undertaking shall be continued accordingly.

(iii) *The name(s) of equipment for which Joint deed of undertaking is to be submitted is to be inserted.

(iv) The manufacturer may be having ongoing collaboration agreement or had collaboration agreement in the past with the collaborator.

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of the Bharat Heavy Electricals Limited [1] (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____ through its Unit at……..(name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) having its registered office at_____[2] hereinafter referred to as the 'Contractor/Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No……dated ……[3] valued at Rs……[4] (Rupees ----------)/FC…….(in words……..) for ……[5] (hereinafter called the 'Contract') and the Contractor having agreed to provide a Contract Performance Guarantee, equivalent to ……% (…. Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we, ……, (hereinafter referred to as the Bank), having registered/Head office at ……. and inter alia a branch at ……. being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer a maximum amount Rs ---------- (Rupees ----------) without any demur, immediately on a demand from the Employer, .

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor/ Supplier in any suit or proceeding pending before any Court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the contractors/supplier shall have no claim against us for making such payment.

We the ……bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We …….. BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Contractor/Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor/Supplier and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor/Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Contractor/Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall remain in force upto and including…….. [6] and shall be extended from time to time for such period as may be desired by Employer.
This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor/Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the ……[7]we shall be discharged from all liabilities under this guarantee thereafter.

We, …….. BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.
Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed…… [8]
b) This Guarantee shall be valid up to ……[9]
c) Unless the Bank is served a written claim or demand on or before _____[10] all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of

(Name of the Bank)

Dated……

Place of Issue……

[1] *NAME AND ADDRESS OF EMPLOYER I.e Bharat Heavy Electricals Limited*

[2] *NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.*

[3] *DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE*

[4] *PROJECT/SUPPLY DETAILS*

[5] *BG AMOUNT IN FIGURES AND WORDS*

[6] *VALIDITY DATE*

[7] *DATE OF EXPIRY OF CLAIM PERIOD*

[8] *BG AMOUNT IN FIGURES AND WORDS.*

[9] *VALIDITY DATE*

[10] *DATE OF EXPIRY OF CLAIM PERIOD*

Note:

1. **Units are advised that expiry of claim period may be kept 2/3 months after validity date.**

2. **In Case of Bank Guarantees submitted by Foreign Vendors-**

   a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.

   b. **From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**

   b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank (BHEL's Consortium Bank). It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.

   b.2 **In case, Foreign Vendors intend to provide BG from** Overseas Branch of our Consortium Bank (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.

   b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). In case, of Foreign Vendors, the BG Format provided to them should clearly specify the same.

   b.4 The BG should clearly specify that the demand or other document can be presented in electronic form.

Sl.	Name of the bank	
1	State Bank of India	
2	Canara Bank	
3	Axis Bank	
4	Bank of Baroda	
5	Central Bank	
6	Citi Bank N.A.	
7	Deutsche Bank **	
8	Exim Bank	
9	Federal Bank Limited	
10	HDFC Bank Limited	
11	Hongkong and Shanghai Banking Corporation Ltd	
12	Indian Bank	
13	ICICI Bank Limited	
14	IDBI Bank Limited	
15	IndusInd Bank Limited	
16	Indian Overseas Bank	
17	Kotak Mahindra Bank Limited	
18	Punjab National Bank	
19	RBL Bank Ltd.	
20	Standard Chartered Bank	
21	Union Bank of India	
22	Yes Bank Limited	
	TOTAL	

HSE CONDITIONS
at a GLANCE (for bidders)



Health Safety and Environment Management

Transmission Business Group, Noida

5th Floor, Tower-A, Plot no. 5, Advant Navis Business Park, Sector-142, Noida-Gr. Noida Expressway, Noida (UP). 201305

BHEL TBG through its long experience and policy, has developed a culture to consider wellbeing of the society, protection of environment and occupational health and safety of its workers first. TBG has also a culture of transparency in all its business activities. In line to this culture, this NIT annexure is prepared as a peeping window in to the TBG HSE requirements which need to be 100% complied by the successful bidders while executing the contract. Interested bidders should go through these HSE conditions:

1. BHEL HSE Policy



In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/ substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, contractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.

Atul Sobti
Chairman & Managing Director

June 5, 2018

Creating BHEL of tomorrow

2. Legal Compliances:

a. Statutory Provisions: All the sub-contractors are to comply with client specific rules and procedures, the National legislations and codes, in particular the following or their revised versions:

Srl. No	Acts/Rules Name	Srl. No	Acts/Rules Name
1	The Factories Act 1948, Amendment Act 1947	11	Contractor labour Act, 1970 (Regulation and abolition)
2	The Environment Act 1986	12	Provident fund Act, 1952
3	Workmen's Compensation Act, 1923	13	Payment of gratuity Act, 1972
4	Building and Other Construction Workers (Regulation of employment and condition of service) Act, 1996	14	Indian Explosives Act and the explosives Rules 2008
5	Buildings and Other Construction Workers Welfare Act, 1996	15	The Gas Cylinder Rules, 2016, Static and Mobile Pressure Vessels (Unfired) Rules 2016
6	Payment of wages Act, 2017 Equal remuneration Act,	16	The Indian Electricity Act 2003 and Indian Electricity Rules 2005
7	Minimum wages Act.1948	17	The Atomic Energy Act, 2015
8	Employers liability Act, 1938	18	The atomic energy (Radiation Protection) Rules. 2004
9	Industrial dispute Act, 1947	19	National Fire Protection Association (NFPA),
10	maternity benefit amendment act 2017	20	National Building Code of India 2016 etc.

b. Indian Standard (IS) Codes related to HSE

All the sub-contractors are to comply with client specific rules and procedures, the National legislations and codes in particular the following or their revised versions:

Srl	IS Code	Applies on
1	IS: 4081 -1986	Safety code for Blasting and Related Drilling operations
2	IS: 3764 -1992	Safety code for excavation work
3	IS: 5121 -1969	Safety code for pilling and other deep foundations
4	IS: 2750 -1964	Specification for steel scaffoldings
5	IS: 3696 (Part-I)-1987	Safety code for scaffolds and Ladders: Part- I Scaffolds
6	IS: 3696 (Part-II) -1991	Safety code for scaffolds and Ladders: Part –II Ladders
7	IS: 4082 -1977	Recommendations on stacking and storage of construction materials at site (First revision)
8	IS: 4130-1976	Safety code for demolition of building (First revision)
9	IS: 4912-1978	Safety requirements for floor and wall openings, railings and toe boards (First revision)
10	IS: 5916- 1970	Safety code for constructions involving use of hot bituminous materials
11	IS: 7205 -1974	Safety code for erection of structural steel work
12	IS: 7969 -1975	Safety code for handling and storage of building materials
13	IS: 8989 -1978	Safety code for erection of concrete framed structures
14	IS: 7293 -1974	Safety code for working with construction machinery
15	IS: 2212 -1991	Pipe lines –Identification –Colour code
16	IS: 5216 -1982	Recommendations on safety procedures &practices in Electrical works (Part -I &II)
17	IS: 875 -1964	Code of practice for structural safety of buildings and loading standards
18	IS: 10386 -1983	General aspects Part-1 -1983, Part-2 -1982, Part-6 -1983, Part-10 -1983- Amenities, Protective clothing and equipment, construction, storage, handling, detection and Safety measures for gases, chemicals and flammable liquids
19	IS: 10500-1991	Drinking water (Specification)

20	IS: 10291 -1982	Code of dress in civil engineering works
21	IS: 2925-1984	Safety helmets
22	IS: 1179-1967	Welding helmets
23	IS: 7524 -1979 (Part-I)	Safety goggles
24	IS: 9167 -1979	Ear muff /Ear plugs
25	IS: 6994 -1973 (Part-I)	Canvas hand gloves, Cotton hand gloves, Chrome leather gloves
26	IS: 4770 -1991	Rubber hand gloves tested for 15,000 volts
27	IS: 3521 -1999	Full body safety harness
28	IS: 11057 -1984	Specification for Industrial safety nets
29	IS: 13415 -1992	Protective Barriers in & around buildings (Code of safety)
30	IS: 13416 -1992	Preventive measures against Hazards at work places-Recommendations part-I Falling materials hazards Prevention part-I
31	IS: 13416 -1992	Preventive measures against Hazards at work places-Recommendations part-II Fall Prevention
32	IS: 15298 -2011 (Part 1&2)	Personal Protective Equipment -Safety shoes
33	IS: 12254 -1993	Poly vinyl chloride (PVC) industrial boots
34	IS: 5557:2004	Industrial and Protective Rubber knee and Ankle boots
35	IS: 2878 -2004	Co2 Type fire extinguisher
36	IS: 2171 -1999	Dry chemical powder fire extinguisher
37	IS: 13849 – 1993	Fire extinguisher for ABC fires
38	IS: 10204-2001	Mechanical Foam type extinguisher (Foam used shall conform to IS: 4989 -1974 and Co2 cartridge shall conform to IS: 4947 -1985)
39	IS: 3786 -1983	Methods for computation of Frequency rate and Severity rates for Industrial injuries and classification of Industrial accidents (First revision)

c. The Sub-contractors need to

- Request for issuance of Form-V in their name from customer on behalf of BHEL
- Get the Labour license registration from concerned Labour office.
- Get the BOCW Registration done along with the labour license.
- Get their labourers registered under BOCW for benefits provided by the office.
- Maintain Seven registers of labours as per BOCW requirement.
- Ensure payment of wages to labours not less than the current minimum wages applicable in the premises.
- Ensure PF deduction of labourers and submission of proof to BHEL office (Wage sheet, ECR & Challan copies) duly signed.
- Submit Labour Payment Certificate by 10th of Every month.
- File timely returns, get renewals done and submit a copy to BHEL office.
- Get Workmen's Compensation policy before the start of work, covering all the labourers and staff,
    - Policy should clearly mention the project name and location,
    - should be as per labour class and wage.
    - Should cover all the height workers with clear mention of Max. height.
    - Policy should be submitted to BHEL office and renewal before expiry.
- Issue employment card to every worker.

3. Labour Welfare and Medical Facilities

a. Labour Welfare

1. Declaration of normal working hours and weekly off day, Payment day & intervals
2. Paid rest days & holidays.
3. Payment of overtime @ twice the normal wage rate.
4. No labour shall be allowed overtime >12 hrs/week, limited to 48 hrs/month.
5. Rest and lunch area.
6. Separate Male/Female Toilets and Lavatories, clearly marked in local Language and provided with signage.
7. Cold and clean drinking water facility suitable to strength and near workplace
8. Creche for children of female workers as per BOCW requirements

9. Arranging labour accommodation in hygienic environment with the facilities of Water (Drinking, Sanitation), washing and bathing area, toilets in sufficient nos., clean and safe camps and surrounding, access road, well illuminated camp and roads, mode of contact, transport facility, first aid centre, 24x7 Security etc.
10. Cooking and eating place to be maintained in hygienic condition
11. General awareness of health and hygiene.

b. Medical facilities and Health centres

- Availability of first aid box at every work location and agency office, with contents as per BOCW requirement.
- Emergency vehicle (four wheeler) at work place
- Availability of stretchers in emergency vehicle and in office.
- Trained first aider
- Medical check-up for all the supervisors and workers including cooks, at the time of induction and annually thereafter.
- Tetanus Vaccination for all in every six months.
- Identification and tie-up with nearby reputed hospital(s) and display of their contact number in Emergency contact list.

4. House Keeping & Storage

Housekeeping is a continuous process and is the part of work. Agencies shall maintain safe and presentable housekeeping all the time in their respective areas, common work locations and passage areas. Roads, passages, staircases, entrance/exit gates shall always be maintained obstruction free. No material shall be left or stacked at the roof edges. Agency shall make arrangements to remove scraps on regular basis and dispose them at a space provided by customer, clearly fenced and marked by the sub-contractor as **"SCRAP YARD"**. Suitable arrangement like dedicated housekeeping team and tractor/hydra should be identified for this work.

Construction materials like shuttering materials, staging materials, cables, re-bars, cements bags, earthing flats and rods, FF pipes, surplus soil etc should be stored/stacked properly such that it should neither pose threat to safety of man nor should obstruct the free movement of man and machineries.

Every sub-contractor should have separate and well maintained storage area for his own materials, T&Ps, PPEs and BHEL issued materials. Consumables like diesel, cotton, grease, oil, paint, admixtures and other fire potential materials should be stored separately with suitable firefighting facility.

Fire capacity of store area to be assessed and accordingly fire extinguishers shall be planned suiting the class and capacity of fire. Sand heaps may also be stacked in open store yards suitably to use in case of fires.

5. Site Safety

a. Induction and others safety trainings

Every sub-contractor shall make arrangement to provide induction training as per BHEL and/or customer requirement on a pre-approved and fixed module to all its new inductees irrespective of class or grade of appointment/hire. He shall also arrange the required facilities for induction training such as board, marker, dummy, posters/banners with all the mandatory PPEs.
Sub-contractor shall also arrange for periodic trainings on fire-fighting, first aid, CPR, importance and use of PPEs, electrical safety, hot work safety, Height work safety, confined space, deep excavations and barricading, concreting work safety etc.

b. Appointment of Safety Officer

Every sub-contractor shall appoint at least one full time qualified safety officer having qualification and experience as specified in Schedule-VIII of BOCW Act-1996. He shall not be assigned any duty/work other than assisting in upliftment of safety practices. He shall perform his duties in accordance with the requirements of Schedule-VIII of BOCW-1996. He shall ensure daily TBT, induction training and other such programs on regular basis.

c. Safety organisation, Safety committees and meetings

Safety officer shall report directly to the head of the projects of the sub-contractor management. There shall be some appointed or nominated safety stewards from each sub-group like shuttering, bar-bending, concreting, brick work, material handling, structure erection, cable laying, pipe work, maintenance, batching plant, housekeeping etc.

A safety committee shall be formed including members from different agencies, BHEL and customer covering at-least 50% participation from workers. Safety committee shall meet on weekly basis or as may be decided by customer, outcomes shall be complied as committed.

d. Personal Protective Equipments.

Unless mentioned otherwise, there will be three mandatory PPEs- Safety shoes, Safety Helmet and Reflective jackets conforming to relevant IS codes as mentioned above.
Every person entering in the project premises shall use above mandatory PPEs.
There will be other PPEs too based on the work requirement like:
Twin lanyard full body harness, fall arresters and life lines for height workers,
Face shield for welders and grinders, Induction helmets and Electrical resistant shoes with FRP/PVC toe for electricians and commissioning engineers, Gum boots for concrete workers and manual excavators, Goggle for gas cutters and grinders, Aprons for welders, shoulder pads for material handlers, Hand gloves – Leather for binders/welders/grinders, certified Rubber gloves for electricians, PVC for concrete/cement handlers, cotton-housekeeping team/brick coolies/erectors, cable laying men and other material handlers. Dust mask for cement handlers.

e. Material Handling

BHEL as a policy discourages continuous manual handling. Material handling contributes a major portion in the project and hence proper means (mechanical/ electrical powered) should be deployed appropriately for this work. Cranes/Faranas/hydras should not be used for material transportation for long distances(>100m), if such movement is un-avoidable, it must be accompanied by a trained signal man. Long materials should be guided by tagline. Roads for material movement should be free from obstructions. Lifting appliances must be in good condition and must have test/inspection certificates.
Lifting tackles like- D-shackles, chains, ropes, slings, belts shall be periodically inspected and shall have valid test certificate and/or third party inspection certificates.
Painted/galvanized structures/materials to be lifted by adequate capacity nylon belts only.
If a machine undergoes a major maintenance, fresh TPI shall be required before use. Hydraulic/pneumatic machines shall be free from leakages. Daily checklist to be filled and witnessed by the concerned supervisor before start of the work.

f. Vehicle/Machinery Documents and other safety requirements

- Crawler mounted boom cranes/Tyre mounted telescopic cranes/tower cranes
  1. Valid third party inspection certificate.
  2. Valid Insurance policy
  3. Registration Certificate (if applicable)
  4. Valid Pollution under control (PUC) (if applicable)

5. Fitness certificate from RTO (if applicable)
6. Operator's valid license, experience and/or competence certificate.
7. Swing horn
8. Reverse horn
9. Boom aviation light
10. Approved Load chart (inside cabin)
11. Fire extinguisher (inside cabin)
12. First aid kit (inside cabin)
13. Boom angle indicator
14. Hook Latch
15. Reflector strips on around cabin and on boom

- Loader backhoe (JCB), crawler excavators (Poclain), Hydra,

1. Valid third party inspection certificate.
2. Valid Insurance policy
3. Registration Certificate (if applicable)
4. Valid Pollution under control (PUC) (if applicable)
5. Fitness certificate from RTO (if applicable)
6. Operator's valid commercial license, experience and/or competence certificate.
7. Reverse horn
8. Approved Load chart (inside cabin) (Hydra)
9. Fire extinguisher (inside cabin)
10. First aid kit (inside cabin)
11. Hook Latch (Hydra)
12. Reflector strips on around cabin and on boom

- Tipper, Transit mixtures (TM), Self-loading concrete mixture (Ajax Fiori), Tractors

1. Valid third party inspection certificate.
2. Valid Insurance policy
3. Registration Certificate
4. Valid Pollution under control (PUC)
5. Fitness certificate from RTO
6. Operator's valid commercial Heavy license, experience and/or competence certificate.
7. Reverse horn
8. Fire extinguisher (inside cabin)
9. First aid kit (inside cabin)
10. Reflector strips on around cabin and on body

Note: 1. Tractors may be allowed with Light Commercial/non-commercial license on customer's consent.

- Cars, Taxis, scooters, motor cycles and other public carriers
    - Valid 2/4 wheeler license (as applicable- commercial/non-commercial)
    - Registration Challan
    - Valid Insurance
    - Pollution under control

g. Man-lifts (Cherry pickers), Scissors Lifts

1. Trained operator with experience/competence certificate and license
2. Valid third party inspection certificate.
3. Valid Insurance policy
4. Registration Certificate (if applicable)
5. Valid Pollution under control (PUC) (if applicable)
6. Swing horn
7. Reverse horn
8. Boom aviation light
9. Fire extinguisher (inside cabin)
10. First aid kit (inside cabin)
11. Reflector strips on around cabin and on boom

Note:

1. No one shall ride man-lift bucket without safety belt, safety shoes, helmet and reflective jacket.
2. Not more than 3 persons at a time will board in bucket of man-lift (without any heavy materials) including operator.
3. Operator will not leave the machine while persons are elevated and working.
4. No one other than the authorised operator will operate the man lifts/Scissors lifts.

h. Excavation

Prior permission/clearance from customer is a must for excavations in areas where underground service services such as gas/water/oil/chemical/electrical lines may be routed. Due precautions shall be taken during excavation in such area. Excavations near water bodies (ponds/canals etc.) shall be done with sand/soil bags ready to plug water from accidental damaged/burst of edges. All the excavations shall be done by either step cutting (min. 600mm step at every 1.5m depth) or slope cutting at 1:2(X:Y axis) (or greater depending upon the soil condition). Where step cutting/slope cutting is not possible due to space constraints, shoring/shuttering or sheet piling to be used to check collapse of soil.

Excavated soil shall be stacked away from edge of the pit, at-least 1.5 meters or half of the depth whichever is higher. Height of the stack shall not exceed 2m in height.

Ramps shall be provided for access of the workers in large pits and ladder of metal/good built for small pits. Ladders shall be of sufficient length protruding at least 1m above the ground level.

Pumps of adequate capacity shall be available for pumping out of water. No lone worker shall be allowed to work in any excavation. Overloaded vehicle shall not be allowed near excavated pits.

i. Bar bending and Binding

Bar bending machine shall be installed under shed/roof. It shall be properly earthed and maintained for operation. Housekeeping of the area shall be team's responsibility on daily basis. All be bar benders shall be given hand gloves (leather/cotton) in addition to mandatory PPEs. Scrap shall be segregated and moved to scrap yard on regular basis. Bar bending station shall be located away from Main plying roads/passages. The station shall be well illuminated, shall have a maintained first aid kit and potable water. Station shall be located in such a way that the movement of the material be minimised.

j. Concreting

No electric vibrators shall be allowed to use. All the concrete workers shall be issued gum boots, safety helmets, reflective jackets and PVC hand gloves. Free fall of concrete from chute shall not exceed 1m in height. Heavy machineries/ vehicles shall be kept at least 2m away from the edge. Emergency vehicle shall be available near concreting work. Late night works shall be avoided, if it is unavoidable, a prior permission from BHEL/Customer is mandatory.

k. Welding, Gas Cutting & other hot works

Welding: Only experienced welders should be deployed for welding jobs. Welders shall be provided with apron, hand gloves, arm pads, leg pads, face shield and safety shoes. Welding leads shall be joint less and insulated. Power input point shall be fully covered at machine.

Gas cutting: If LPG is being used, domestic cylinder is strictly prohibited inside the project premises, (not allowed for site kitchen too). Hose pipes shall be in good condition without cracks, cuts, punctures or joints. Ends should be clamped with worm clamps. Dial gauges shall be of good quality and duly calibrated. Flash back arresters is a must for both oxygen/acetylene or LPG/Oxygen combination. Cylinders shall be stored, transported and used in vertical position only. When not in use, they shall be capped. Empty and filled cylinders to be stored separately with distinct marking.
Cylinders shall neither be rolled on the ground nor thrown during loading/unloading.

Grinding: Grinder shall be given clear glass face shield, apron, safety shoes, ear muffs and hand gloves. Grinder machines shall have wheel guard. Plug tops to be used for power connection preferably three wire type. Only trained persons shall be allowed to use grinders, abrasive cutters. Electrical connection shall be free from cuts, joints etc.

l. Erection & Height Work

Only trained filters and experienced helpers shall be engaged in erection work. Step bolts of lattice towers shall be checked for full tightness with spring washers before use. Height pass shall be issued to the identified group of erectors who have passed medical test and have working experience at height. Name of such workers shall be displayed at appropriate place. These workers only shall be allowed to work at height. Height work shall not be permitted in high wind/bad weather condition, during raining or in night/dark.

m. Electrical Safety

BHEL usually provided single point power source and sub-contractors draw power from there. Otherwise agencies make their own arrangement for construction power like DG sets etc. Sub-contractors shall submit their load requirement (amperage & phase) to BHEL before start of work. Accordingly, they shall make arrangements to draw power and distribution arrangements too in a safe way. MCCBs and HRC fuses to be put in circuit for short circuit and overload protections and RCCBs of 30mA sensitivity to be put at each distribution panel for human safety. Earthing pits shall be installed at each distribution point and maintained below three Ohm resistivity which shall be inspected randomly. The distribution points shall be clean, free from vegetation and water logging, easily accessible and covered/protected from three sides and top for rain. Earthing of DBs shall be done by 25x3mm GI flats connected from proper earth pits. Insulation mat, PVC Sheet/Wooden plank to be placed before DBs as platform. DB Sheds shall be legibly marked with name of agency, contact no of electrician and SLD of that DB. Only industrial plugs and sockets shall be allowed. Three wire (Phase, neutral and earth) system shall be used for tools, lights and machineries and two wire power draw shall be strictly prohibited. PTW and LOTO system shall be maintained to work on LT system. Name and contact no of authorised electricians who will be responsible of electrical power facility maintenance shall be submitted to BHEL by Agencies. Unauthorised sharing of power from one agency to other is strictly prohibited. Electricians shall use standard PPEs and insulated tools only. Standard and tested/certified discharge rods to be used in the areas where there is a possibility of residual current or induction charge. The induction rod to be connected to the earth first and removed in the last. Induction helmets only to be used in the charged area. Electricians to be provided with electrical resistant safety shoes having FRP/PVC toe.

n. Dust Gases and fumes

Sub-contractor shall make arrangements to avoid accumulation of dust fumes and gases. Cement handlers inside store or at batching plant and gravel spreader shall be given effective nose masks and jaggery (at least 200g per person per day). DG sets and other machineries like cranes excavators etc. shall have valid and effective PUC certificate and shall have maintained engine with silencer. No IC engine operated machine shall be used in confined and covered area like hall, sheds, store etc. where accumulation due to lack of ventilation can increase to harmful levels. Dedicated arrangements (tanker or tractor with sprinkler) shall be made by the sub-contractors (individual or jointly) to continuously subside the dusts arising out of the movement of the vehicles roads/passages. Welding activities near roof accumulates harmful gases. Welders in such positions shall be provided with effective masks conforming to IS standards.

o. Vehicular Traffic

Speed limits defined within the premises shall strictly be followed by the drivers/commuters of construction as well as other vehicles.

Every construction machinery, man-lift shall display the name, contact no and passport size photograph of the authorised operator (There can be one or more authorised operators).

No one other than operator and co-operator shall sit inside the cabin of any construction machine while it is working.

Construction machineries (tractor, trucks, tippers, JCBs, hydra, Fassi cranes etc. shall never be used as mode of public transport. Machineries like Ajax Fiori and hydra shall not be driven in back direction except for small distances. No overloaded vehicle shall be permitted entry in the project premises.

Over speeding shall be reported and driver/operator shall be barred from entry or shall be penalised.

Drunken drivers shall be barred from entry in the project.

Carrying harmful weapons like knives (>6"), guns etc. shall permanently disqualify the person from entry in project premises.

p. Barricading and floor openings

Every pit deeper than 4 feet (1.2m) shall be barricaded immediately after excavation and will remain barricaded till backfilling.

Pits/trenches drains near roads, passages whether temporary or permanent shall be hard barricaded and well illuminated. Roof edges and openings shall be strictly hard barricaded and illuminated. Height works like masonry works, structure erection, erection by cranes, Lattice tower/beam erection areas shall be barricaded to restrict entry. Areas under charging/commissioning shall be barricaded and caution boards shall be displayed on newly charged areas.

q. Scaffold & Ladder

No bamboo/wooden scaffold shall be allowed to be used. Only tubular steel scaffolds with couplers conforming to the relevant IS codes shall be allowed with base plates. Standard steel or wooden planks to be used as platforms and no packing materials shall be used. All the platforms shall be built with provisions of **top rail at 1m height, mid rail at 0.5m height and toe boards of min 6" height** at floor level. Minimum width of platform shall be 900mm and if wheel barrow is to be used then 1200mm. Means of access to be provided in the form of ladders, ramps or staircase. Multilevel work platforms or those platforms having passage underneath shall be provided with safety net, screen or canopy at each level for protection from falling objects. Platforms shall be free from concrete, debris or other materials. Platforms shall not extend out of the putlogs and shall be secured and fastened. Decking shall be made non-skidding.

Scaffolds under erection shall be tagged **"RED"**, under repair/maintenance/inspection shall be tagged **"YELLOW"** and ready for use shall be tagged **"GREEN"**

Only metal ladders in the construction site and FRP ladders in charged areas shall be allowed. Ladders made from packing materials shall not be used. Ladders shall be securely fixed at bottom, top and long ladders at middle points too at an interval not more than 2400mm and must have a landing at every 6m. Inclination angle should be approximately 1:4 (X:Y) or 75deg. Ladder must extend at least 1m above the platform/access area. Gap between two rungs shall not exceed 300mm. Portable ladder should not be more than 4m in length. Minimum width of the ladder shall not be less than 300mm.

Use of Mobile aluminium scaffold is preferably advisable for erection of transformers/reactors.

r. Illumination

The sub-contractor shall ensure that the areas such as work stations, buildings, batching plants, passages/roads, stores, rest areas, power sources, staircases etc. are illuminated sufficiently to make safe work conditions at site and shall not be less than the relevant IS standards. Excavations/ below ground level structures near passages/roads shall also be sufficiently illuminated.

s. Safety banners/posters, caution boards

Sub-contractors shall display boards and banners in sufficient quantity having safety signs, slogans, important messages, pictures, cautions at prominent locations to promote safety and spread awareness for important precautions such as “Deep Excavation Ahead”, Speed Limit”, “Charged Area”, “Do not operate”, “Hard hat area”, “No smoking Zone” etc. Boards containing messages of Emergency contacts, First aid facility, rates of minimum wages, working hours, rest day etc. should be displayed at specific areas.

t. Waste management and disposal

Sub-contractor shall make suitable and effective arrangement to remove waste material from site on regular basis and store them in an identified and safe location. Disposal of wastes shall also be done as per manufacturer’s instructions or as per the guidelines laid by legal authorities. Re-bars, Cement bags, packing material (wooden/metal/plastic/paper), paint, oil, grease, cables (armour, sheathing, insulation), civil debris, metal chips, GI sheet scraps, batteries etc. are the common waste materials. Sub-contractor shall arrange disposal of the hazardous wastes/materials in conformance to the legal and contractual requirements only.

u. Inspection of PPEs, T&Ps, Machineries and lifting appliances

All the PPEs, T&P and lifting appliances purchased newly by sub-contractors shall have test certificates which shall be submitted to BHEL office periodically or on demand. There shall be at least monthly joint inspection schedule for inspection of healthiness of all the PPEs, T&Ps and lifting appliances. All the lifting appliances shall be tested and examined by a competent person before taking into use for the first time or after it has undergone any alterations or repairs liable to affect its strength or stability

and also once at least in every twelve months. To confirm quality of the PPEs as per the relevant IS codes, BHEL may ask sub-contractors to get any or all types of PPEs tested through NABL approved lab as per relevant IS codes. At any stage, the 100% cost of such tests shall be in the scope of respective sub-contractors.

v. Cable Laying

Sub-contractor shall ensure cable trenches free from water, mud, debris, snakes, Scorpios, lizards before start of the work in trenches. Cable drum rollers shall be used to pull cables out of drums to avoid twisting of cables. Hand gloves, Safety shoes/gum boots, reflective jackets, safety helmets shall be provided to the workers. Cable laying area shall be well illuminated.

w. Fire Protection

Every sub-contractor has to maintain their working area, store and office area free from bushes. Stacking of flammable materials like wood, paper, plastic, paint, oil, grease, fuel, cotton, gases etc. at isolated place disconnected from other storage and office areas. Adequate arrangements of firefighting means like suitable extinguishers, fire/water buckets, water tanks, sand dunes etc. shall be made by the agency depending upon the fire capacity assessed or as per MSDS. Fire drills and trainings on how to operate fire extinguishers and how to react in case of fire breakouts shall be the part of regular training program. Guards and store persons must be a regular participant of such training programs. A list of trained firefighting persons and periodicity of such training programs shall be submitted to BHEL by every agency and same to be adhered. Sufficient number of fire extinguishers with suitable class shall be placed at such locations where there can be fire hazard like stores, pantry, office, DG set, electrical distribution panels etc.

x. Fencing of exposed rotating parts

Exposed rotating parts poses great threat to the person in vicinity. Such parts need to be fenced/covered. Guards are mandatory of grinders, abrasive cutters. Flywheels of the engines of heavy machines, Diesel engines, DG sets need to be covered. Electric winch machines, pulleys, chains, shafts, exhaust fans at reachable height, table fans, need to be caged/fenced. Such fencing/guard shall not be removed while machinery is in operation.

y. Emergency preparedness response plan and periodic mock drills.

Sub-contractor shall comply JSA (Job Safety Analysis) and arrange to mitigate the effects of identified possible hazards. He shall also define following in response to emergency preparedness:
An emergency assembly point and put a board of the same with information to all in induction training.
Have facility of ambulance or tie-up with nearest hospital for service in minimum possible time (Max-30min) if there is not ambulance inside the premises.
Ensure availability of emergency vehicle with driver all the time at site during work.
Conduct mock-drills on possible risks like electrocution, fall from height, fire, heat stroke etc., record responses and take photographs to submit in BHEL office. Stretchers availability in emergency vehicle or at work place should be well accessible. Provide fire extinguishers of right type at right place in right quantity with information to all. Display emergency contact nos. to various risk locations and at office, service building or at major work locations. Provide first aid training by doctors for and display names of such trained first aiders and fire fighters. Rescue kit with trained staff or man lift or both to rescue a man hanging by safety belt at height. Provide running water tap near chemical storage and handling points. Agencies shall follow emergency response plan prepared by BHEL in each area of work, store and office.

z. Safety reports & Reporting of accidents

BHEL will provide ''formats and checklists'' for the purpose of records/documents pertaining to the compliance of aforesaid clauses. Agencies shall be responsible for strict adherence and compliance for timely generation and fill-up of the checklists and reports. These shall be submitted on weekly and monthly basis as specified in the formats.

Agency shall also promote such an environment that the near misses, incidents and accidents are reported by every person, whosoever witnesses them. These shall help in analysing the trend and taking measures in reducing/stopping the accidents/incidents. Initial reporting can be in any form-by call, SMS, WhatsApp, e-mail, letter etc.

Major and fatal accidents or high potential incidents shall be investigated for route cause and outcomes shall be immediately implemented to check recurrences.

6. General conditions and penalty clauses

Following are the general conditions:

PPEs shall not only bear the ISI mark but also be conforming to the required standards, 100% compliance of the PPEs is mandatory.

Over speeding of vehicles shall attract penalty/notice and recurrence will attract debarring from entry into project premises.

Hiding of facts like incidents, accidents, fake/forged reports/certificates shall also attract penalty/ notice or both. Only approved third party agencies shall be allowed to inspect the machines, T&Ps. Reports shall directly be sent to BHEL/customers by the third parties.

Insurance and TPIs to be renewed before expiry. Machines, T&Ps shall not be allowed to work if renewal delayed. Continuity of WC policy to be maintained religiously by the respective agencies.

Agency shall submit the status report of his labour license, BOCW registration, WC Policy, insurance & TPI validity on monthly basis with list of machineries and T&Ps

Sub-contractors shall also maintain a buffer stock of all the PPEs in at least 20% excess to the present strength of the work force.

If construction power is not drawn as per the guidelines laid in clause no. 5(m), given above, BHEL may take-up this work at the risk and cost of the agency and/or may withhold a sum of min. Rs. 50,000/- (Rs. Fifty Thousand) or more as the site in-charge deems fit till the system is aligned as per aforesaid requirement.

Agencies shall be responsible for the compliance of the above requirements. Failure in one or more clauses/area shall attract a notice or monitory penalty or a combination of above.

Monitory penalty will be

- Rs. 1000/- per person/incident per day for non-conformity in above areas.
- A Major/severe accident shall attract a penalty of Rs. 2,00,000/- per head
- Fatality or permanent disability with total loss of earning capacity, if any, will attract a penalty of Rs. 5,00,000/- (Rs. Five Lakh).
- Further fatality/permanent disability shall attract double the last penalty imposed on the agency.
- Above penalties are exclusive of medical expenses of the victim or compensation to the family through insurance policy (WC Policy or group insurance).
- **Penalties imposed by customer shall be fully transferable to the sub-contractor. In the event of above cases, penalties shall be imposed whichever will be higher.**

- Evaluation of agency's performance on HSE compliance shall be done as per BHEL guide lines/system.

Revision History

Revision Date	Revision No.	Old Text	New Text	Reason	Revised by (with sign)

BHARAT HEAVY ELECTRICALS LTD.
(TRANSMISSION BUSINESS GROUP)

GENERAL TERMS AND CONDITIONS FOR TENDER ENQUIRY / CONTRACT

This is to be submitted duly signed by bidder in original (NOT REQUIRED FOR ENQUIRY THROUGH E-PROCURMENT MODE). Clause-wise deviations and / or additional conditions / clarifications, if any, are to be brought out clearly in "Schedule of Commercial Deviation". Deviations and / or additional conditions / clarifications, if any, mentioned elsewhere in the bid / offer, shall not be considered.

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1.	**INSTRUCTION TO BIDDERS :** 1.1 Sealed bids are invited for the items mentioned in the tender enquiry conforming to the NIT including Technical Specifications. Bids should be typed and free from overwriting and erasures. Corrections or additions / deletions, if any, must be clearly written and attested, otherwise offer may be rejected. 1.2 Bidder must ensure that their bid is submitted / dropped in the tender box on or before **14-00 Hrs.** IST on the due date of opening, unless otherwise specified in the NIT, at the address as follows :- Tender Box, Materials Management, Transmission Business Group, Bharat Heavy Electricals Limited, 5th Floor, Tower-A, Advant Navis IT Business Park, Plot-7, Sector-142, Noida Expressway, Noida, Dist. G. B. Nagar, U. P. – 201305 **1.3** In case tender enquiry is floated though the e-procurement system, offer / bid has to be submitted through the e-procurement system **ONLY** as per instructions given in the e-procurement portal **(https://bhel.abcprocure.com/EPROC/).** 1.4 The bids shall be opened at 14-30 Hrs. IST on the due date of opening, in the presence of participating bidders who may like to be present, unless otherwise specified in the NIT. Bids received late are liable for rejection. Bidders sending bids by courier or post will have to ensure that it is timely delivered at the above address. 1.5 Bids are to be submitted duly signed with seal in two parts :- a) **Techno-commercial Bid (Part-I**) – To be submitted in 2 sets (original + copy). A copy of Price Bid (Part-II) clearly mentioning all the necessary information as per format **without prices** "Un-Priced Bid" is also to be enclosed in Part-I Bid. b) **Price Bid (Part-II)** – To be submitted only in one set in a separate sealed envelope. This should not contain any Technical and / or Commercial Terms and Conditions. The rates should be quoted both in figures and words.

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	1.6 The Part-I and Part-II Bids are to be sealed in separate envelopes and marked as "Techno-commercial Bid (Part-I)" and "Price Bid (Part-II)" respectively. Both the envelopes are to be kept in another common envelope and marked as "BID". Each envelope should be sealed and superscribed with tender enquiry no., item / package name, project name and due date of opening. Bidder's name and address shall also be mentioned on each envelope. 1.7 For any technical clarification, please contact official mentioned in the tender enquiry / NIT. 1.8 For any commercial clarification please contact official issuing tender enquiry / NIT. 1.9 Price bid (Part-II) should not contain any additional information / description other than given in "Un-Priced Bid" submitted with "Techno-commercial Bid (Part-I)" except prices, otherwise bid is liable for rejection. 1.10 Price Bid submitted along with the bid shall remain valid up to validity of offer. Any discount / revised offer submitted by the bidder on its own shall be accepted provided it is received before the due date and time of offer submission (i.e. Part-I Bid). The discount shall be applied on pro-rata basis to all items including optional items, if any, unless specified otherwise by the bidder. Discount offered shall be valid for full duration of validity of the offer including extension of validity, if any. Unsolicited Supplementary / Revised Price Bid submitted after the due date and time of offer submission (i.e. Part-I Bid), during validity period of offer, unless asked by BHEL, shall not be considered. Withdrawal of quotation by the bidder, at any stage after its opening, may entail suitable action against such bidder by BHEL. 1.11 The consultants / firm (and any of its affiliates) shall not be eligible to participate against tender enquiry for the related goods or works or services for the same project, if they were engaged by BHEL-TBG for the consultancy services. 1.12 In case any Foreign OEM / Foreign Principal insists on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer / supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer / supplier or the manufacturer / supplier could bid directly but not both. In case bids are received from the manufacturer / supplier and the agent, bid received from the agent shall be ignored. 1.13 Non-conformities / errors / discrepancies in quoted prices in price bids shall be dealt as follows :- a) If, in the price structure quoted for the required goods / services / works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of BHEL there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly. b) If there is an error in a total corresponding to the addition or subtraction

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	of subtotals, the subtotals shall prevail and the total shall be corrected. c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above. d) If there is such discrepancy in an offer as mentioned in (a), (b) & (c) above, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the BHEL, the bid is liable to be ignored. 1.14 In case the scope of the successful bidder / supplier against this tender enquiry includes Erection, Testing and Commissioning (ETC) of the equipment / material at site in addition to Supply, Purchase Order shall be placed for Supply Portion and Contract shall be separately awarded for ETC at Site Portion. General Terms and Conditions for Tender Enquiry / Contract mentioned herein shall be applicable for both Supply & ETC at Site. Additional Terms and Conditions for Tender Enquiry / Contract for Erection, Testing and Commissioning at Site "BHEL/TBG/GTC-ETC/2016 REV01" shall be applicable for ETC at Site only which is to be read in conjunction with General Terms and Conditions for Tender Enquiry / Contract mentioned herein. However, any breach of either the Purchase Order or the Contract shall be deemed to be breach of the other. 1.15 Taxes and Duties payable extra as per Clause No. 2.3 in NIT, if not specified/quoted clearly as extra shall be considered as included in Ex-works Price and therefore shall not be reimbursed. Taxes and duties not payable extra as per NIT shall be deemed to be included in Ex-works Price. 1.16 If the rates for taxes and duties in respect of the quoted materials and / or services assumed by the Supplier are less than the tariff prevailing at the time of tendering, Supplier will be responsible for such under quotations. However if the rates assumed are higher than the correct rates prevailing at the time tendering, the difference will be to the credit of BHEL. Note : Representative / official deputed by the bidder to witness tender opening must produce authorization letter for the same.
2.	**PRICES :** 2.1 Unless specifically indicated in the NIT, all prices shall be FIRM. No enhancement of rate for whatsoever reasons unless and until asked by BHEL shall be allowed. 2.2 Unless specifically indicated in the NIT, the prices shall be on INR basis. 2.3 Unless specifically indicated in the NIT, the prices are to be quoted on FOR (Site / Destination) basis excluding GST. The break-up of prices shall be as under :- a) Ex-works Price: Ex-works price including packing & forwarding charges.

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	b) Freight: Freight for door delivery up to destination / site / store are to be quoted separately. c) Insurance: Insurance for door delivery up to destination / site / store are to be quoted separately. d) Type Test Charges: If asked in the technical specification, it is to be quoted separately for each test. e) Charges for Supervision of Erection, Testing & Commissioning (ETC) at Site: To be quoted separately if specified in NIT/Price Schedule. f) Charges for Testing & Commissioning at Site: To be quoted separately if specified in NIT/Price Schedule. g) Charges for Erection, Testing & Commissioning at Site: To be quoted separately if specified in NIT/Price Schedule. h) Training Charges: To be quoted separately if specified in NIT/Price Schedule. 2.4 **GST rates** along with HSN/SAC code as applicable on Sr No (a) to (h) above is to be mentioned separately in percentage in both un-priced bid and price bid. Note : i) Unless otherwise specified in the NIT, the purchase order shall be placed on Ex-works basis for Indian bidders. ii) Prices quoted by Indian bidders shall be in Indian Rupees only. iii) In case Supervision of Erection, Testing & Commissioning (ETC) at Site or Testing & Commissioning at Site or Erection, Testing & Commissioning at Site is also in scope of the bidder along with supply, bidder has to ensure that prices quoted for such services also are in line with special terms & conditions of the NIT, if any. iv) Unless otherwise specified in the NIT, Unloading at Site / Destination shall not be in the scope of the supplier. v) Prices in respect of Sr No (a) to Sr No (h) of Clause 2.3 above are to be quoted inclusive of all taxes & Duties, charges. Levies, royalty etc. if any, excluding GST.
3.	**TERMS OF PAYMENT :** 3.1 **For Supply only in scope of the supplier** 100% of payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows : · LR / GR duly endorsed by BHEL Site Official. · Material Receipt Certificate issued by BHEL Site Official. . GST Compliant Tax Invoice · Packing List (Case-wise) · Copy of Transit Insurance Certificate from underwriters. · Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management · Guarantee Certificate · Copy of Performance Bank Guarantee (PBG) · Certificate of acceptance of Type Test Reports issued by BHEL Engineering

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	Management wherever specifically mentioned in the Purchase Order. 3.2 **For Supply where Supervision of Erection, Testing & Commissioning (ETC) at Site is in scope of the supplier or Supply where Testing & Commissioning at Site is in scope of the supplier** a) 95% of payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows : · LR / GR duly endorsed by BHEL Site Official. · Material Receipt Certificate issued by BHEL Site Official. . GST Compliant Tax Invoice · Packing List (Case-wise) · Copy of Transit Insurance Certificate from underwriters. · Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management · Guarantee Certificate · Copy of Performance Bank Guarantee (PBG) · Certificate of acceptance of Type Test Reports issued by BHEL Engineering Management wherever specifically mentioned in the Purchase Order. b) 5% of payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows : · Certificate of successful completion of Supervision of Erection, Testing & Commissioning at Site if it is in the scope of the supplier or Certificate of successful completion of Testing & Commissioning at Site if it is in the scope of the supplier. · Certificate of completion of final documentation as per Purchase Order / Technical Specification issued by BHEL Engineering Management 3.3 **For Supply where Erection, Testing & Commissioning (ETC) at Site is in scope of the supplier** a) 90% of payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows : · LR / GR duly endorsed by BHEL Site Official. · Material Receipt Certificate issued by BHEL Site Official. · GST Compliant Tax Invoice · Packing List (Case-wise) · Copy of Transit Insurance Certificate from underwriters. · Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management · Guarantee Certificate · Copy of Performance Bank Guarantee (PBG) · Certificate of acceptance of Type Test Reports issued by BHEL Engineering Management wherever specifically mentioned in the Purchase Order b) 10% of payment within 60 days from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows : · Certificate of successful completion of Erection, Testing & Commissioning at Site issued by BHEL Site Official / Construction Management · Certificate of completion of final documentation as per Purchase Order / Technical Specification issued by BHEL Engineering Management 3.4 For Type Test Charges

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	100% payment along with applicable GST within 60 days from the date of receipt of complete GST compliant Tax invoice along with copy of Certificate of acceptance of Type Test Reports issued by BHEL Engineering Management in 3 sets (original + 2 copies) on completion of delivery (at site, if F&I is in scope of supplier) of main supplies (excluding spares) for which Type Tests are applicable. List of main supplies (excluding spares) for which Type Tests are applicable shall be certified by BHEL Engineering Management. 3.5 For Charges for Supervision of Erection, Testing & Commissioning at Site 100% payment along with applicable GST within 60 days from the date of receipt of complete GST compliant Tax invoice along with certificate of successful completion of Supervision of Erection, Testing & Commissioning at Site issued by BHEL Site Official / Construction Management in 3 sets (Original + 2 copies). 3.6 For Charges for Testing & Commissioning at Site 100% payment along with applicable GST within 60 days from the date of receipt of complete GST compliant Tax invoice along with certificate of successful completion of Testing & Commissioning at Site issued by BHEL Site Official / Construction Management in 3 sets (Original + 2 copies). 3.7 For Training Charges 100% payment along with applicable GST within 60 days from the date of receipt of complete GST compliant Tax invoice along with certificate of completion of training issued by BHEL Engineering Management in 3 sets (original + 2 copies). Note : i) Supplier has to submit invoice(s) as per PO or approved billing break-up of prices (if applicable as per NIT). ii) In case of supplies for overseas project, Material Receipt Certificate issued by BHEL Authorized Representative shall also be acceptable. iii) In case of Transit Insurance under Open Insurance Policy, Intimation / Declaration of Transit Insurance as per terms of the relevant Open Insurance Policy along with copy of Open Insurance Policy from underwriters shall also be acceptable. iv) Supplier has to ensure commencement of transit insurance from the date not later than LR / GR date. v) Supplier has to submit Tax Invoice(s). Supplier should ensure that Tax Invoice should comply all statutory requirements under GST Law to enable BHEL to avail input credit vi) MSMED Act, 2006 and the rules made thereunder as amended from time to time shall be applicable for release of payment to suppliers qualified & registered as Micro & Small Enterprises based on documents mentioned in the NIT for MSME.

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	vii) Supplier has to submit PBG (as per BHEL format) & Guarantee Certificate as per PO terms. viii) In case any shortages and / or damages in supplies, an amount calculated based on comments against Material Receipt Certificate issued by the BHEL Site Official shall be withheld from the supply payment against 3.1(a) or 3.2(a) above to be deemed fit by BHEL subject to a minimum of 10% of the total ex-works value of the invoice corresponding to the LR / GR against which any shortages and / or damages are reported. The withheld amount shall be released after the shortages and / or damages in supplies are supplied / replenished against Certification by BHEL Site Official. ix) Payment of GST component shall be made only if vendor has deposited the Tax and credit for the same is reflected in GSTN (GST Network). In case credit of the same is not reflected in GSTN , vendor may alternatively furnish BG of GST Amount for a period valid for not less than 1 month .In case of disallowance of credit /non reflection of credit in GSTN , amount will be recovered from supplier along with applicable Interest , penalty etc from any of his dues. x) If GST is payable by BHEL on reverse Charge Mechanism basis, vendor should ensure the submission of GST compliant Tax invoice immediately on dispatch/ performance of service. In case of non-compliance any additional charges towards interest , penalty etc , will be to vendors account. xi) TDS under GST Act, if applicable, shall be deducted unless Exemption Certificate If applicable, from the appropriate authority is furnished to BHEL along with Invoice.
4.	**INTEREST LIABILITY :** In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment. Also, no interest shall be payable by BHEL on the bank guarantee / deposit amount or balance payment or any other money which may become due owing to difference or misunderstanding or any dispute before any quasi judicial authority between BHEL and the Supplier / Contractor.
5.	**GUARANTEE :** The equipment / material supplied and services rendered (if applicable) shall be guaranteed to be free from all defects and faults in design & engineering, material, workmanship & manufacture and in full conformity with the Purchase Order / Contract, Technical Specifications & approved drawings / data sheets, if any, for 18 months from the date of last delivery or 12 months from the date of commissioning, whichever is earlier. Wherever Erection, Testing & Commissioning at Site are also in the scope of the Supplier, the guarantee period shall be 18 months from the date of last delivery or 12 months from the date of commissioning, whichever is later. The defective equipment / material / component shall be replaced free of cost at site. Freight & Insurance during transit shall also be in the scope of the supplier / contractor. Any expenditure for dismantling and re-erection of the replaced equipment / material / component shall be to supplier's / contractor's account. All replacements during the guarantee period shall be delivered at site promptly and satisfactorily within a period not more than 45 days from the date of reporting the defect / rejection etc.

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	In the event of the supplier / contractor failing to replace the defective equipment / material / component within the time period mentioned above, BHEL may proceed to undertake the replacement of such defective equipment / material / component at the risk and cost of the supplier / contractor without prejudice to any other rights under the contract and recover the same from PBG / other dues of this Purchase Order / Contract or any other Purchase Order / Contract executed by the supplier / contractor. Note : i) In case of Illumination System, items viz. Lamps, Tubes, Ballast, Starters, Capacitors & Fuses will not be under Guarantee after commissioning. ii) In addition to the above guarantee period, Extended Guarantee / Warranty, if any, shall be as per NIT / Technical Specifications. iii) In case offer of agent of Foreign OEM / Foreign Principal is considered, as per Clause No. 1.12 above, Guarantee as mentioned above has to be provided by the Foreign OEM / Foreign Principal also.
6.	**LATENT DEFECT :** Liability for latent defects shall be for defects inherently lying within material or arising out of design deficiency which does not manifest itself during guarantee period but later and shall be limited to five years from the expiry of the guarantee period.
7.	**PERFORMANCE BANK GUARANTEE (PBG) :** Supplier shall arrange to submit Performance BG / deposit on a non-judicial stamp paper of appropriate value along with first invoice or within 60 days from placement of Purchase Order (PO) whichever is earlier, in line with one of the applicable options as follows :- <u>Option "A"</u> A single rolling PBG for Rs. 50 Lakhs initially valid for 18 months with claim period of 3 months extra over and above 18 months for all the Purchase Orders being executed for Transmission Business Group, BHEL. However, validity of the PBG shall be extended till 18 months from the date of last delivery with 3 months claim period extra over and above 18 months. Single Rolling PBG option shall not be applicable in case Ex-works value of the PO at the time of placement of PO exceeds Rs. One Crore. <u>Option "B"</u> PBG for 10% of the total Ex-works PO value, valid for 18 months from the date of last delivery with claim period of 3 months extra over and above 18 months. Ex-works PO value at the time of placement of PO shall be considered for calculation of the PBG amount. <u>Option "C"</u> In case the total Ex-works PO value at the time of placement of PO does not exceed Rs. Ten Lakhs, interest free Deposit of 10% of the total Ex-works PO value at the time of placement of PO in form of Demand Draft favouring "Bharat Heavy Electricals Limited" and payable at New Delhi / Delhi / Noida shall also be acceptable to BHEL in lieu of PBG, which shall be released after expiry of 21 months from the date of last delivery after deduction, if any, within 60 days from receipt of invoice in 3 sets (original + 2 copies) to be submitted by the supplier. Note : i) The Bank Guarantee shall be from any bank as per Annexure for List of Banks (32 Nos.). The original PBG should be sent by issuing Bank directly to AGM (Finance), TBG, BHEL, Noida.

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	ii) Extension of validity of the PBG in original, as per above clause, should be sent by issuing Bank directly to AGM (Finance), TBG, BHEL, Noida at least 45 days before expiry of validity of the PBG. iii) Unless otherwise specified in the NIT, deviation taken for non-submission of PBG / Deposit, as applicable, shall not be accepted. iv) Supplier has to confirm one of the applicable options for submission of PBG / Deposit before placement of PO. v) In case of non–submission PBG / Deposit, as applicable, BHEL reserve the right for Risk Purchase as per terms of the NIT and impose Suspension of Business Dealings with the Supplier / Contractor. vi) BHEL reserve the right to encash the Bank Guarantee and forfeit the amount in the event of any default, failure or neglect on part of the Supplier in fulfilment of performance of the Purchase Order. vii) Value of the Bank Guarantee (at the time of submission) shall remain unchanged for any subsequent variations in Purchase Order value up to ± 20%. Beyond this variation of ± 20%, the Supplier shall arrange to enhance or may reduce the value of the Bank Guarantee accordingly for the total variation promptly. viii)Vendor to ensure submission of Certificate of Final Documentation /Confirmation regarding Non applicability of Final Documentation, as the case may be, as referred in clause No 9 regarding Final Documentation. BG shall be released only after submission of the same to BHEL TBMM.
8.	**SUBMISSION OF DRAWINGS / DOCUMENTS FOR APPROVAL :** Supplier shall submit the master document list within 7 days from date of Purchase Order / Contract, unless otherwise specified in the NIT, with planned dates for submission which shall be in line with activity schedule as per Purchase Order / Contract and shall be finalized with BHEL Engineering Management. Date of first submission of drawings / documents shall be certified by BHEL Engineering Management after the receipt of applicable drawings / documents (e.g. project specific cover sheet, GTP, OGA drawings, schemes, type test reports etc.) by BHEL. During detailed engineering stage, necessary hard copies of the engineering drawings / documents shall also be submitted by the supplier as per the Purchase Order / Contract requirement. The supplier shall also submit the packing drawings as per technical specifications. In case item(s) offered require any interface details of other item (not in the scope of supplier & required for operating the equipment), the supplier has to submit interfaces schedule along with submission of engineering drawings / documents. It shall be responsibility of the supplier to get the details of the interfaced item from BHEL before manufacturing to avoid any mismatch at site.
9.	**FINAL DOCUMENTATION :** Final documentation as called in the Technical /contract specification is to be submitted within 3 months from the date of first delivery of respective equipment, item/material. After submission of Final Documentation, BHEL Engineering Management (TBEM) will issue a Certificate of Completion of Final Documentation. Wherever Final Documentation is not applicable, BHEL Engineering Management (TBEM) will issue confirmation regarding the same, Vendor to submit the Certificate of Final Documentation /Confirmation regarding Non applicability of Final Documentation, as the case may be, to BHEL TBMM. In case of Non Submission of Certificate of Final Documentation /Confirmation regarding Non applicability of Final Documentation, BG will be liable for encashment.
10.	**INSPECTION :** BHEL / customer / third party shall inspect equipment / material before despatch. Stage inspection during manufacturing may also be carried out. Material to be despatched only after getting Material Despatch Clearance Certificate (MDCC) / MICC issued by BHEL.

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	Supplier shall send inspection call on prescribed format / web site only, with an advance notice of 15 days. Supplier to ensure submission of all routine / acceptance test reports, inspection reports and all other documents related to inspection, immediately to BHEL. BHEL representative is authorised to carry out audits along with Third Party Inspection Agency at vendor's / supplier's works before clearing the items for despatch.
11.	**DESPATCH DOCUMENTS :** Despatch documents to be immediately sent to BHEL on despatch are as follows :- • Copy of Invoice • Copy of LR / GR in case of Indian suppliers or BL / AWB in case of foreign suppliers • Copy of Packing List (Case-wise) • Copy of Transit Insurance Certificate from underwriters • Copy of Guarantee Certificate
12.	**DELIVERY PERIOD :** Delivery / Completion requirement shall be mentioned in the NIT. Bidder to specify best delivery / completion period possible in weeks from the date of LOI / PO as per activity schedule for consideration by BHEL. Time required for type test, if applicable, is to be separately indicated. Note : LR / GR date or invoice date (whichever is later) for indigenous supplies and BL / AWB date for FOB / CIF (if applicable) contracts shall be considered as delivery date.
13.	**LIQUIDATED DAMAGES FOR DELAYED DELIVERY**: In case of delay in execution of Purchase Order beyond the contractual delivery time, an amount of 0.5% of the total Purchase Order value for supply (excluding. taxes and duties as applicable) per week of delay or part thereof subject to a maximum of 10% of the total Purchase Order value for supply (excluding taxes and duties as applicable) shall be deducted as Liquidated Damages (LD). However, in case of staggered (lot-wise) contractual delivery schedule, an amount of 0.5% of the total Purchase Order value for supply (excluding. taxes and duties as applicable) per week of delay or part thereof subject to a maximum of 10% of the total Purchase Order value for supply (excluding taxes and duties as applicable) shall be deducted as Liquidated Damages (LD). Note : i) In case of any amendment / revision in P.O./WO, the LD shall be linked to the amended / revised Purchase Order / Contract value and delivery / completion time / schedule, if applicable. ii) LR / GR date or invoice date (whichever is later) for indigenous supplies and BL / AWB date for FOB / CIF (if applicable) for imported supplies shall be treated as the date of dispatch for levying LD as above. iii) However, for indigenous supply, if time period between date of receipt of material at site / destination by Site Official & the date of LR / GR or invoice (whichever is later) is more than 30 days, where distance from place of despatch as per LR / GR is upto 1000 Kms or if time period between date of receipt of material at site / destination by Site Official & the date of LR / GR or invoice (whichever is later) is more than 45 days, where distance from place of despatch as per LR / GR is

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	more than 1000 Kms, such excess period shall also be considered for LD purpose. iv) If, as per supplier, delay is not attributable to the supplier, delay analysis with documentary evidence may be submitted by the supplier at the earliest but not later than six months from the end of the financial year in which the payment is withheld. Based on the above details / documents submitted by the supplier, BHEL shall take final decision and if considered appropriate by BHEL, withheld amount (full or part as the case may be) shall be released, otherwise, full or balance withheld amount shall be treated as deduction of Liquidated Damages (LD) towards delayed delivery.
14.	**VALIDITY OF OFFER :** The offer shall be valid for 180 days from the due date of opening of tender (i.e. techno-commercial bid unless otherwise specified in the NIT). Prices of Spares, wherever they optional items, shall be valid till two years from the date of placement of PO.
15.	**ACCEPTANCE / REJECTION OF TENDER :** BHEL reserve the right to reject in full or part, any or all tender without assigning any reason thereof. BHEL also reserve right to vary the quantities as mentioned in the NIT. Acceptance of offer is subject to vendor approval by customer before opening of price bid. BHEL shall not be bound by any power of attorney granted by tenderer or by changes in composition of the firm made subsequent to award of order / contract. BHEL may however recognize such power of attorney and changes after obtaining proper legal advice, cost of which will be chargeable to the seller / contractor concerned. If the tenderer deliberately gives wrong information, BHEL reserves the right to reject such an offer at any stage or cancel the order / contract, if awarded, and forfeit the security deposit and bank guarantee.
16.	**DEVIATION :** The bids having deviation(s) w.r.t. tender are liable for rejection. However, BHEL, at its discretion, may load the prices for evaluation of offer with prior intimation to bidder.
17.	**TENDER EVALUATION :** Comparative statement shall be prepared and evaluated on total cost basis at destination/site (as per terms of NIT) considering overall quantity indicated in NIT unless contrary to same is specifically mentioned in the tender enquiry / NIT. Total cost for this purpose shall include cost of scope of work as mentioned in NIT along with applicable taxes & duties, and other services etc. (if applicable). GST input credit available to BHEL shall be reduced from prices while determining L1 status. In case all bidders are foreign & Port of Import (destination port) is same for all the bidders, evaluation of offers shall be done on CIF (Port of Import) basis. Otherwise, evaluation of offers shall be done on the basis of delivered cost at site /destination to BHEL. Further, in case of foreign bidders, marine freight & insurance are to be quoted separately & the purchase order may be placed on FOB basis with an option for delivery on CIF / CFR basis, if required, later. In case of foreign bidders, Exchange Rate (TT selling rate of State Bank of India) as on date of tender opening (Part-I Bid in case of two part bid) shall be considered. If the relevant day happens to be a bank holiday, then the forex rate as on the previous bank (SBI) working day shall be taken for tender evaluation.
18.	**LOADING CRITERIA :** List of permissible deviations & loading criteria thereof are as follows :- a) Payment Terms Base rate of SBI (as applicable on the date of bid opening / techno-commercial

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	bid opening in case of two part bids) + 6% shall be considered for loading for the period of relaxation sought by bidder(s) against terms of payment in the NIT. b) Liquidated Damages (LD) for Delayed Delivery Loading on LD clause shall be to the extent to which it is not agreed to by the bidder (at offered value). c) In case of foreign bidders, if the quoted prices is on CIF basis only, it shall be loaded to arrive at total FOR (Site / Destination) price, as applicable, by factors as follows :- i) Port handling / clearing charges: @ 1% of CIF value to arrive at Customs Assessable Value. ii) Custom Duty (including CVD & SAD) as per NIT prevailing on date of price bid opening. iii) Inland Freight & Transit Insurance: @ 5% of CIF value where distance between site / destination and Port of Discharge is upto 1000 Kms or @ 7% of CIF value where distance between site / destination and Port of Discharge is more than 1000 Kms. Note : Additional deviations (if considered acceptable by BHEL) & the loading criteria shall be communicated to all the qualified bidders before price bid opening.
19.	**ARBITRATION :** In the event of any dispute emanating from and relating to this contract, the matter shall be referred to the sole arbitration of the person appointed by the competent authority of BHEL. Subject to aforesaid, the provisions of "The Arbitration and Conciliation Act, 1996" and the rules made thereunder as amended from time to time in India shall apply to the arbitration proceedings. The venue of arbitration shall be in New Delhi. Further there shall be no claim for any pre-reference or pendente-lite interest on the claims and any claim for such interest made shall be void. However, in case of contract with Public Sector Enterprise / Undertaking (PSE/PSU) or Govt. Dept., the extant guidelines of Govt. of India shall be followed.
20.	**LEGAL SETTLEMENT :** Indian Courts at New Delhi / Delhi shall have exclusive jurisdiction to decide the dispute, if any, arising out of or in respect of the contract(s) to which these conditions are applicable. Contract, including all matters connected with contract, shall be governed by the Indian Law, both substantive and procedural, for the time being in force including modification thereto.
21.	**SUB-CONTRACTING :** In case further subcontracting of BHEL Purchase Order / Contract or part thereof is envisaged by supplier, the same can be done after written permission is obtained from BHEL. However it shall not absolve the Supplier / Contractor of the responsibility of fulfilling BHEL Purchase Order / Contract requirements. In case of subcontracting of Purchase Order / Contract awarded by BHEL or part thereof without such permission, BHEL reserve the right to cancel the Purchase Order / Contract and source such material / component / equipment / system from any other agency at the risk and cost of the Supplier / Contractor. If Supplier / Contractor is an individual or proprietary concern and the individual or the proprietor dies or the partnership is dissolved or substantially affected, then unless BHEL is satisfied that legal representative of individual Supplier / Contractor or proprietor of proprietary concern and surviving partners of partnership firm are capable of carrying out and completing the Purchase Order / Contract, BHEL shall be entitled to cancel the Purchase Order / Contract as to its incomplete portion and

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	without being in any way liable to payment of any compensation to legal representative of Supplier / Contractor and / or to surviving partners of Supplier's / Contractor's firm on account of cancellation of the Purchase Order / Contract. Decision of BHEL that legal representatives of deceased Supplier / Contractor or surviving partners of the Supplier's / Contractor's firm cannot carry out and complete the Purchase Order / Contract shall be final and binding on the parties hereto. Terms and Conditions shall not get affected in case of de-merger / amalgamation / taking-over / re-constitution etc.
22.	**RISK PURCHASE :** In case the Supplier / Contractor fails to supply or fails to comply with terms & conditions of the Purchase Order / Contract or delivers equipment / material not of the contracted quality or fails to adhere to the contract specifications or fails to perform as per the activity schedule and there are sufficient reasons even before expiry of the delivery / completion period to justify that supplies shall be inordinately delayed beyond contractual delivery / completion period, BHEL reserve the right to cancel the Purchase Order / Contract either in whole or in part thereof without compensation to Supplier / Contractor and if BHEL so desires, may procure such equipment / material / items not delivered or others of similar description where equipment / material / items exactly complying with particulars are not readily procurable in the opinion of BHEL which is final and in such manner as deemed appropriate, at the risk and cost of the Supplier / Contractor and the Supplier / Contractor shall be liable to BHEL for any excess cost to BHEL. However, the Supplier / Contractor shall continue execution of the Purchase Order / Contract to the extent not cancelled under the provisions of this clause. Recovery amount on account of purchases made by BHEL at the risk and cost of Supplier / Contractor shall be the difference of total value of new Purchase Order (PO) value and total value of old Purchase Order for applicable items, where the total value of new PO is more than total value of old PO for applicable items, plus additional 15% of the total ex-works value of new PO as overheads. The Supplier / Contractor shall on no account be entitled to any gain on such risk & cost purchase. In case the purchase order (PO) value of the new PO is less than the PO value of the old PO, 15% of the total ex-works value of the new PO shall be recovered as overheads and the difference between the PO value of the old PO and the new PO shall not be considered for calculation of the recovery amount.
23.	**ADJUSTMENT OF RECOVERY :** Any amount payable by the Supplier / Contractor under any of the condition of this contract shall be liable to be adjusted against any amount payable to the Supplier / Contractor under any other Purchase Order / Contract awarded to him by any BHEL unit. This is without prejudice to any other action, as may be deemed fit, by BHEL.
24.	**FORCE MAJEURE CONDITION :** If by reason of war, civil commotion, act of god, Government restrictions, strike, lockout which are not in control of Supplier / Contractor the deliveries / services are delayed, Supplier / Contractor shall not be held responsible. If at any time during the continuance of the Purchase Order / Contract, the performance in whole or in part by either party of any obligations under the Purchase Order / Contract is prevented or delayed by reason of any war hostilities, acts of the public enemy, restrictions by Govt. of India, civil commotion, sabotage, fires, floods, explosion, epidemics, quarantine restrictions, strike, lock-outs or acts of God (hereinafter referred to as "event"), which are not in control of Supplier / Contractor or BHEL, then provided notice of the happening of such event is given by either party to the other within fifteen (15) days from the date of occurrence thereof, neither

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	party shall by reason of such event be entitled to terminate the Purchase Order / Contract nor shall have any claim for damages against each other in respect of such non-performance and delay in performance. Performance under the Purchase Order / Contract shall be resumed immediately after such event has come to an end or ceased to exist and decision of BHEL as to whether the deliveries have to be resumed or not shall be final, conclusive and binding on the parties hereto. In the event of the parties hereto not able to agree that a force majeure event has occurred, the parties shall submit the disputes for resolution pursuant to the provisions hereunder, provided that the burden of proof as to whether a force majeure event has occurred shall be upon the party claiming such an event. Notwithstanding above provisions, BHEL shall reserve the right to cancel the Purchase Order / Contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of delivery and other schedules.
25.	**MANUFACTURING QUALITY PLAN (MQP) :** Supplier to submit approved MQP in line with requirement of BHEL/customer.
26.	**SUPPLIER PERFORMANCE MONITORING AND RATING SYSTEM :** BHEL reserve the right for evaluation of Supplier Performance Rating as per Supplier Performance Monitoring and Rating System of BHEL for necessary action. Details are available at BHEL Website www.bhel.com for reference.
27.	**DEALING WITH BANNED SUPPLIERS / CONTRACTORS IN BHEL :** Offers of the bidders, who are on the banned list, as also the offers of the bidders who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL website www.bhel.com for reference.
28.	**ORDER OF PRECEDENCE :** The order of precedence shall be as follows :- a) Special Terms & Conditions (STC) for Tender Enquiry / Contract, if any b) General Terms & Conditions (GTC) for Tender Enquiry / Contract & Additional General Terms & Conditions (GTC) for Tender Enquiry / Contract for Erection Testing & Commissioning (ETC) at Site, if applicable Provisions in (a) above shall prevail over (b). In case of conflict, between Technical Specifications and STC / GTC, bidder to seek necessary clarifications from BHEL concerned official as specified in NIT.
29.	**PACKING :** Packing shall be in conformity with specifications and shall be such as to ensure prevention of damages, corrosion, deterioration, shortages, pilferage and loss in transit or storage. In case of shipment by sea or air, the packing shall be sea-worthy or air-worthy respectively and of international standards. Different types of spares i.e. start-up / commissioning spares and initial spares (mandatory spares and recommended O&M spares) are to be packed separately. Packing List shall be submitted as per standard format along with advance set of documents for claiming payment which shall also indicate :- a) Case / Packing size (as applicable). b) Gross weight and net weight of each package. c) Detailed contents of the package with quantity of each item separately. Project, Item / Package Description, BHEL's PO No. with date & Case / Packing Mark should also be clearly mentioned on the Case / Packing and Packing List for identification. Also, Packing List must be duly signed & should include respective Invoice No. & LR No. Note : Foreign suppliers to furnish details to arrange inland transportation by BHEL, if

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	applicable, as follows :- i) No. of Packages ii) Size with Weight (Gross & Net) of each Package iii) No. of Containers with type & size required for inland transportation iv) Type of Cargo (Break Bulk / LCL / FCL) v) Customs Tariff No.
30.	**COLOUR CODING :** Aluminium stickers are required to be attached to large components but plastic sheet tags should be tied with small components, giving details like purchase order, description of the component, quantity etc. Tags should be of the colour as follows :- a) Main equipment : Yellow or White tag b) Start-up / Commissioning spares : Blue tag c) Mandatory spares : Pink or Red tag d) Recommended / O&M spares : Green tag
31.	**MICRO, SMALL & MEDIUM ENTERPRISES (MSME) :** MSMED Act 2006 as amended from time to time & extant regulations of Govt. of India for MSME will be applicable. Micro & Small Enterprises (MSE) can avail the intended benefits only if they submit along with the offer / bid, attested copies of either Acknowledgement of Entrepreneur Memorandum Part-II (EM-II certificate) having deemed validity (five years from the date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM-II certificate along with attested copy of a CA certificate (As per BHEL format where deemed validity of EM-II certificate of five years have expired) applicable for the relevant financial year (latest audited). Date to be reckoned for determining the deemed validity will be the date of opening (for Techno-commercial Bid : Part-I in case of two part bid). Non-submission of such documents will lead to consideration of their bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or arrested (in original) by a Gazetted officer. Copy of Udyog Aadhaar Memorandum with Acknowledgement of Ministry of Micro, Small & Medium Enterprises should also be furnished.
32.	**BUSINESS ETHICS / SUSPENSION OF BUSINESS DEALINGS WITH SUPPLIERS / CONTRACTORS :** If any bidder / supplier / contractor during pre-tendering / tendering / post tendering / award / execution / post-execution, indulges in malpractices cheating, bribery, fraud or other misconduct or formation of cartel so as to influence the bidding process or influences the price or fails to perform or is in default without any reasonable cause etc or performs any act considered objectionable as per extant guidelines, action may be taken against such bidders/supplier/contractor as per extant "Guidelines for Suspension of Business Dealings with Suppliers/Contractors". Abridged version of same is available at BHEL website (www.bhel.com) on "Supplier Registration" Page.
33.	**REVERSE AUCTION :** BHEL reserve the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder or price bid submitted by the bidder through e-procurement system. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA. In case BHEL decides to go for Reverse Auction, only those bidders who have given their unconditional acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit "online sealed bid in the

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	Reverse Auction. Non-submission of "online sealed bid" by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue. General Terms and Conditions of RA are available at Annexure. Business Rules for RA shall be sent to the bidders before conducting RA. Abridged Version of "Common Guidelines for Conducting Reverse Auction" may also be seen at BHEL website (www.bhel.com) on "Supplier Registration" Page & "Tender Notifications" Page.
34.	**INTEGRITY PACT :** Bidders shall have to enter into Integrity Pact with BHEL, duly signed with seal in original, if specified in NIT / RFQ failing which bidder's offer shall be liable for rejection.
35.	**TERMINATION OF CONTRACT :** BHEL shall have the right to cancel the Purchase Order / Contract without any financial implication to BHEL if vendor approval by end user / customer is withdrawn or in case of Suspension of Business Dealings with the Suppliers / Contractors by BHEL. BHEL shall have the right to cancel Purchase Order / Contract, wholly or in part, in case they are obliged to do so on account of any decline, diminution, curtailment or stoppage of their business and in that event, the Supplier's / Contractor' compensation claim shall be settled mutually. In case of cancellation of Purchase Order / Contract for main supply, all other associated Purchase Orders / Contracts like those for Mandatory Spares / Recommended Spares / Erection, Testing & Commissioning (ETC) / Supervision of ETC, if any, would also get cancelled.
36.	**SHELF LIFE** Supplier has to inform the list of the items / sub-items which have limited shelf life like consumables or those required for the first fill and shall indicate the corresponding shelf life period in the offer. Such items / sub-items shall be manufactured / despatched only after getting formal clearance from BHEL.
37.	**LIMITATION OF LIABILITY :** Notwithstanding any other provisions, except in cases of wilful misconduct and / or criminal negligence / acts, a) Neither the Supplier / Contractor nor BHEL shall be liable to the other, whether in Purchase Order / Contract, tort, or otherwise, for any consequential loss or damage, loss of use, loss of production or loss of profits or interest costs, provided however that this exclusion shall not apply to any obligation of the Supplier / Contractor to pay Liquidated Damages to the BHEL and b) Notwithstanding any other provisions incorporated elsewhere in the contract, the aggregate liability of the Contractor in respect of this contract, whether under the Contract, in tort or otherwise, shall not exceed total Contract Price, provided however that this limitation shall not apply to any obligation of the Vendor to indemnify BHEL with respect to Patent Infringement or Intellectual Property Rights.
38.	**SHORTAGES / DAMAGES :** a) Against Supply only or Supply where Supervision of Erection, Testing & Commissioning (ETC) at Site or Supply where Testing & Commissioning at Site is in scope of the supplier : Any shortages and / or damages in supplies shall be supplied / replenished free of cost by the supplier as early as possible but not later than 30 days from the

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	date of intimation by BHEL to the supplier. b) Against Supply where Erection, Testing & Commissioning (ETC) at Site is in scope of the supplier : Any shortages and / or damages in supplies and during handling / storage, erection, testing and commissioning at site shall be supplied / replenished free of cost by the Supplier / Contractor, as early as possible, to meet the contractual completion time / schedule. Note: There shall not be any extension in the contractual delivery time / schedule due to any shortages and / or damages in supplies.
39.	**VARIATION OF CONTRACT VALUE / QUANTITY VARIATION :** BHEL shall have the right to variation in quantities of items within **± 20%** of the total Purchase Order / Contract value at the time of placement of PO or award of Contract on overall basis for all amendments together within two years from the date of original Purchase Order / Contract or completion of execution of the Purchase Order / Contract whichever is earlier but quantities of individual items may vary to any extent or may get deleted unless otherwise specified in the technical specifications. No compensation is payable due to variation in the quantities and the Supplier / Contractor shall be bound to accept the same the contracted prices / rates without any escalation. However, if the Purchase Order / Contract is on "Lumpsum" basis, no variation of Purchase Order / Contract value shall be admissible to the Supplier / Contractor within the scope of Purchase Order / Contract, as long as the inputs remain unchanged.
40.	**STATUTORY VARIATION :** GST rates prevailing at the time of dispatch of goods/ completion of services shall be payable by BHEL. All other taxes, duties, charges, royalty,cess ,other levies shall be deemed to be included in the Ex Works Prices /Charges quoted by bidders and no variations shall be payable in respect thereof . No other variations such as on customs duty, exchange rate, minimum wages, prices of controlled commodities, any other input etc. shall be payable by the BHEL. Notwithstanding anything above, where the actual completion of the supply / services occurs beyond the period stipulated in the Purchase Order / Contract or any extension thereof, variations referred to above, will be limited to the rates prevailing on the dates of such agreed completion periods only. For variations after the agreed completion periods, the Supplier / Contractor alone shall bear the impact for the upward revisions and for downward revisions BHEL shall be given the benefit of reduction in applicable taxes /GST. This will be without prejudice to the levy of liquidated damages for delay in delivery / completion. If new tax is introduced by Central/ State Govt/ Municipality becomes directly applicable on items specified in Bill of Quantities/Purchase Order/Contract, full reimbursements shall be made provided it becomes applicable on items specified in Bill of Quantities. However, any additional tax implication due to delay in delivery, beyond the Contractual Delivery, attributable to supplier shall be borne by supplier.
41.	**MODE OF PAYMENT :** Payment shall be made directly to the Supplier / Contractor by BHEL through NEFT / RTGS.
42.	**CONFIDENTIALITY :** Supplier / Contractor shall, at all times, undertake to maintain complete confidentiality of all data, information, software, drawings & documents etc. belonging to BHEL and also of systems, procedures, reports, input documents, manuals, results and any other BHEL documents discussed and / or finalized during the course of execution of Purchase Order / Contract.

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43.	**INDEMNIFICATION :** The Supplier / Contractor shall indemnify and keep indemnified and hold harmless BHEL and its employees and officers from and against any and all claims, suits, actions or administrative proceedings, demands, losses, damages, costs and expenses and any other claim of whatsoever nature in respect of the death or injury of any person or loss of or damage to any property arising during the course and out of the execution of the Purchase Order / Contract.
44.	**TITLE OF GOODS :** a) Ownership of the equipment / material procured in India, shall be transferred to BHEL upon loading on to the mode of transport to be used for transportation of the said equipment / material from the works to the site / destination and upon endorsement of the dispatch documents in favour of BHEL. b) Ownership of the equipment / material to be imported into the country where the site is located, if not procured in India, shall be transferred to BHEL upon loading on the mode of transport to be used for transportation of the equipment / material from the country of origin to that country / destination and upon endorsement of despatch document in favour of BHEL. c) Notwithstanding the transfer of ownership of the equipment / material, the responsibility for care and safe custody thereof together with the risk of loss or damage thereto for whatsoever reason shall remain with the Supplier.
45.	**COMPLIANCE OF STATUTORY REQUIREMENTS :** The vendor shall comply with all State and Central Laws / Acts, Statutory Rules, Regulations etc., as may be enacted by the Government during the tenure of the Purchase Order / Contract and having in force and applicable to the Purchase Order / Contract and nothing shall be done by the Supplier / Contractor in contravention of any Law / Act and / or Rules / Regulations, thereunder or any amendment thereof. The Supplier / Contractor shall pay all taxes, fees, licence charges / deposits, duties, tolls, royalty, commissions or other charges which may be levied on account of any of his operations connected with the Purchase Order / Contract. In case BHEL is constrained to make any of such payments, BHEL shall recover the same from the Supplier / Contractor either from moneys due to him or otherwise as deemed fit.
46.	**ACCEPTANCE OF ORDER :** Supplier should acknowledge and accept the Letter of Award / Purchase Order issued by BHEL within 7 days of the issue of Letter of Award / Purchase Order. In case of any discrepancy / typographical error in issue of Purchase Order / Contract, the agreed terms & conditions, scope of work, rates / prices for placement of PO / award of contract shall be applicable and BHEL reserves the right to issue amendment(s) to PO / Contract for correction of discrepancies / typographical errors in the PO / Contract at a later date.
47.	**FRAUD PREVENTION POLICY :** The Bidder along with its associate / collaborators / sub-contractors / sub-vendors / consultants / service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice.

Signature of Bidder (Authorized Signatory) with Date & Seal

SCHEDULE OF COMMERCIAL DEVIATION

This Format is to be submitted in original duly signed by bidder.
The following are the devitions/variations/exceptions from the Terms and Conditions :-

S N	CLAUSE NO. OF TERMS AND CONDITIONS	STATEMENT OF DEVIATION

NIL-DEVIATION

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

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

Note : Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Signature of the authorised representative of

Place : ……

Date : …….

Bidder's name :……

Designation:……..

Company Seal:……

SCHEDULE OF TECHNICAL DEVIATION

This Format is to be submitted in original duly signed by bidder.
The following are the devitions/variations/exceptions from the Terms and Conditions :-

S N	CLAUSE NO. OF TERMS AND CONDITIONS	STATEMENT OF DEVIATION

NIL-DEVIATION

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

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

Note : Continuation Sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.

Signature of the authorised representative of

Place : ……

Date : ……

Bidder's name :……

Designation:……..

Company Seal:……

No.25-111612018-PG

Government of India

Ministry of Power

Shram Shakti Bhawan, Rafi Marg, New Delhi • — 110001

Tele Fax: 011-23730264

Dated 02/07/2020

ORDER

Power Supply System is a sensitive and critical infrastructure that supports not only our national defence, vital emergency services including health, disaster response, critical national infrastructure including classified data & communication services, defence installations and manufacturing establishments, logistics services but also the entire economy and the day-today life of the citizens of the country. Any danger or threat to Power Supply System can have catastrophic effects and has the potential to cripple the entire country. Therefore, the Power Sector is a strategic and critical sector.

The vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment. Hence, to protect the security, integrity and reliability of the strategically important and critical Power Supply System & Network in the country, the following directions are hereby issued:-

1. All equipment, components, and parts imported for use in the Power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards.
2. All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MOP).
3. Any import of equipment/components/parts from "prior reference" countries as specified or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these "prior reference" countries will require prior permission of the Government of India
4. Where the equipment/components/parts are imported from "prior reference" countries, with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MOP).

This order shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in power supply system or any activity directly or indirectly related to power supply system.

This issues with the approval of Hon'ble Minister of State for Power and New & Renewable Energy (Independent Charge).

(Goutam Ghosh)

Director Tel: 011-23716674 To:

1. All Ministries/Departments of Government of India (As per list)
2. Secretary (Coordination),Cabinet Secretariat
3. Vice Chairman, NITI Aayog

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Item Wise BoQ

Tender Inviting Authority: BHEL TBG NOIDA

Name of Work: Design, Engineering, Supply, Erection*, Testing & Commissioning of 220 kV GIS at 220 kV Subzi Mandi Substation on turnkey basis.

Enquiry/NIT No:

Name of the Bidder/ Bidding Firm / Company :	

PRICE SCHEDULE

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

NUMBER #	TEXT #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER	NUMBER #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Item Code / Make	Quantity	Units	Unit RATE In Figures To be entered by the Bidder in Rs. P	GST (in Percentage)	GST Amount (Unit Rate*Quantity* GST) Rs. P	Unit Freight & Insurance Charges in Rs. P	GST (in Percentage)	GST Amount on F&I (Unit Rate*Quantity*GST) Rs. P	HSN / SAC Code	TOTAL Ex-Works + F & I AMOUNT excluding GST in Rs. P	TOTAL Ex-Works + F & I AMOUNT including GST in Rs. P	TOTAL AMOUNT In Words
1	2	3	4	5	13	14	15	16	20	21	51	53	54	55
1.01	SUPPLY- GIS: 220KV, 2500 A, SF6 GAS INSULATED BUS BAR MODULE	item1	2	SET			0.00			0.00		0.000	0.000	INR ero Only
1.02	SUPPLY- GIS: 220KV, 2500 A, SF6 GAS INSULATED BUS COUPLER FEEDER BAY MODULE	item2	1	SET			0.00			0.00		0.000	0.000	INR ero Only
1.03	SUPPLY- GIS: 220KV, 1600 A, SF6 GAS INSULATED TRANSFORMER FEEDER BAY MODULE	item3	4	SET			0.00			0.00		0.000	0.000	INR ero Only
1.04	SUPPLY- GIS: 220KV, 1600 A, SF6 GAS INSULATED GIS LINE FEEDER BAY MODULE	item4	6	SET			0.00			0.00		0.000	0.000	INR ero Only
1.05	SUPPLY- GIS : 220KV, 1600 A, SINGLE PHASE SF6 TO AIR BUSHING OUTSIDE GIS HALL (INCLUDING SF6 GAS, SUPPORT STRUCTURE & HARDWARES)	item5	24	NO.			0.00			0.00		0.000	0.000	INR ero Only
1.06	SUPPLY- GIS : 220KV, 1600A, SINGLE PHASE GAS INSULATED BUS DUCT OUTSIDE GIS HALL (INCLUDING SF6 GAS, SUPPORT STRUCTURE & HARDWARES)	item6	350	MTR			0.00			0.00		0.000	0.000	INR ero Only
1.07	SUPPLY- GIS: SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	item7	1	Lot			0.00			0.00		0.000	0.000	INR ero Only
1.08	SUPPLY- GIS: STRUCTURE MATERIAL INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER MATERIALS ETC.	item8	1	Lot			0.00			0.00		0.000	0.000	INR ero Only
1.09	SUPPLY- GIS: EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, AS APPLICABLE	item9	1	Lot			0.00			0.00		0.000	0.000	INR ero Only
1.10	GIS CABLE TERMINATION ENCLOSURE, INDOOR TYPE, SUITABLE FOR 220KV CABLE TERMINATION	item10	6	NO.			0.00			0.00		0.000	0.000	INR ero Only

1.11	GIS CABLE TERMINATION ENCLOSURE, OUTDOOR TYPE, SUITABLE FOR 220KV CABLE TERMINATION	item11	6	NO.			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.01	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: SF6 Gas filling and evacuating plant	item12	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.02	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: SF6 Gas Analyser	item13	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.03	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: SF6 gas leak detector	item14	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.04	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Gas masks	item15	10	Nos.			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.05	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Partial Discharge Monitoring System	item16	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.06	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Contact resistance meter	item17	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
2.07	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Circuit Breaker operational Analyzer	item18	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
3.01	SUPPLY- GIS: Deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of equipment	item19	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
4.01	SUPPLY- GIS: SPARES: 220KV, GIS- Single phase, Cable end termination connection & enclosure, compatible with the main Circuit	item20	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
4.02	SUPPLY- GIS: SPARES: 220KV, GIS- SF6 gas Pressure Relief Devices (03 nos. of each type)	item21	2	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
4.03	SUPPLY- GIS: SPARES: 220KV, GIS- SF6 Pressure gauge cum switch OR Density monitors cum switch as applicable (3 nos. of each type) (1 set complete for 1 bay + bus bar, Bus duct+ CB)	item22	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
4.04	SUPPLY- GIS: SPARES: 220KV, GIS- Coupling device with pressure gauge for connecting Gas handling plant including GIS & Cylinder both	item23	2	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
4.05	SUPPLY- GIS: SPARES: 220KV, GIS- Rubber Gaskets, "O" Rings and Seals for SF6 gas of each type	item24	1	Set			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
4.06	SUPPLY- GIS: SPARES: 220KV, GIS- Molecular filter for SF6 gas with filter bags (20% of total quantity)	item25	1	Lot			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only

4.07	SUPPLY- GIS: SPARES: 220KV, GIS- All types of Control Valves for SF6 gas of each type	item26	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.08	SUPPLY- GIS: SPARES: 220KV, GIS- SF6 gas (20% of total quantity)	item27	1	Lot			0.00			0.00		0.000	0.000	INR	ero Only
4.09	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- For 3 phase Enclosure	item28	2	Nos.			0.00			0.00		0.000	0.000	INR	ero Only
4.10	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- For single phase enclosure	item29	3	Nos.			0.00			0.00		0.000	0.000	INR	ero Only
4.11	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- Bus Support insulator of each type for 3 phase/ single phase	item30	1	Lot			0.00			0.00		0.000	0.000	INR	ero Only
4.12	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- SF6 to air bushing of each type rating including fixing arrangement	item31	3	Nos.			0.00			0.00		0.000	0.000	INR	ero Only
4.13	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Circuit Breaker pole complete of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	item32	3	Nos.			0.00			0.00		0.000	0.000	INR	ero Only
4.14	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Fixed, moving and arcing contacts including insulating nozzles(3 nos. of each type/ rating of CB)	item33	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.15	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Rubber gaskets, `O' rings and seals for SF6 gas of each type	item34	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.16	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Trip coil assembly with resistor as applicable (3 nos. of each rating of CB)	item35	2	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.17	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Closing coil assembly with resistor as applicable (3 nos. of each rating of CB)	item36	2	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.18	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Corona rings/ cover if applicable	item37	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.19	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating	item38	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.20	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Closing valve assembly (3 nos. of each type)	item39	2	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.21	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Trip valve assembly (3 nos. of each type)	item40	2	Set			0.00			0.00		0.000	0.000	INR	ero Only

4.22	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Auxiliary switch assembly (3 nos. of each type)	item41	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.23	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Operation Counter (3 nos. of each type)	item42	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.24	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Rupture disc (3 nos. of each type)	item43	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.25	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Spring operated closing mechanism, if applicable (1 nos. of each type)	item44	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.26	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hydraulic operating mechanism with drive motor (3 nos. of each type)	item45	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.27	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hydraulic filter (3 nos. of each type)	item46	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.28	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hose pipe (3 nos. of each type)	item47	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.29	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- N2 Accumulator (3 nos. of each type)	item48	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.30	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure transducer (3 nos. of each type)	item49	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.31	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Valves (3 nos. of each type)	item50	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.32	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pipe length (copper & steel) (3 nos. of each size & type)	item51	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.33	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure switches (3 nos. of each type)	item52	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.34	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure gauge with coupling device (3 nos. of each type)	item53	1	Set			0.00			0.00		0.000	0.000	INR	ero Only
4.35	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hydraulic oil (20% of total qty used)	item54	1	Lot			0.00			0.00		0.000	0.000	INR	ero Only
4.36	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure Relief Device, (3 nos. of each type)	item55	2	Set			0.00			0.00		0.000	0.000	INR	ero Only

4.37	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Complete set of 3 nos. of single phase / one no. of 3-phase disconnector including main circuit, enclosure, driving mechanism.	item56	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.38	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- 3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism.	item57	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.39	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Copper contact fingers for dis-connector male & female contact for one complete (3 phase) dis-connector of each type and rating.	item58	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.40	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Copper contact fingers for earthing switch male & female contacts, for one complete (3 phase) earthing switch of each type and rating	item59	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.41	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	item60	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.42	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Push button switch.-each type, as applicable	item61	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.43	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Limit switch and Aux. Switches for complete 3 phase equipment	item62	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.44	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Motor with gear assembly for complete 3 phase equipment for Isolator	item63	3	Set			0.00			0.00		0.000	0.000	INR ero Only
4.45	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Motor with gear assembly for complete 3 phase equipment for Earth Swicth	item64	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.46	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Hinge pins for complete 3 phase equipment	item65	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.47	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Relays, Power contactors, resistors, fuses, push buttons & MCBs (complete for one 3 phase equipment)	item66	3	Nos.			0.00			0.00		0.000	0.000	INR ero Only
4.48	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Aux. switch assembly (complete) with 10 NO & 10 NC OR more contacts for both isolator & earth switch	item67	1	Set			0.00			0.00		0.000	0.000	INR ero Only
4.49	SUPPLY- GIS: SPARES: 220KV, Current Transformer- Complete CT of each type and rating with packing.	item68	2	Nos.			0.00			0.00		0.000	0.000	INR ero Only
4.50	SUPPLY- GIS: SPARES: 220KV, Current Transformer- Secondary bushing of each type	item69	2	Set			0.00			0.00		0.000	0.000	INR ero Only
4.51	SUPPLY- GIS: SPARES: 220KV, Voltage Transformer- Complete PT of each type and rating	item70	1	Nos.			0.00			0.00		0.000	0.000	INR ero Only

4.52	SUPPLY- GIS: SPARES: 220KV, Surge Arrestor- Complete LA of each type and ratings with insulating base, terminal connector, Surge counter & accessories	item71	1	Nos.			0.00			0.00		0.000	0.000	INR ero Only
5.01	SUPPLY- GIS: SPARES: 220KV, SINGLE PHASE BUS BAR	item72	1	Mtrs			0.00			0.00		0.000	0.000	INR ero Only
5.02	SUPPLY- GIS: SPARES: 220KV, GIS METALLIC ENCLOSURE	item73	50	Kgs			0.00			0.00		0.000	0.000	INR ero Only
5.03	SUPPLY- GIS: SPARES: 220KV, EXPANSION BELLOWS/ JOINTS	item74	1	Set			0.00			0.00		0.000	0.000	INR ero Only
5.04	SUPPLY- GIS: SPARES: 220KV, TEE BEND	item75	1	Set			0.00			0.00		0.000	0.000	INR ero Only
5.05	SUPPLY- GIS: SPARES: 220KV, ANGLE BEND	item76	1	Set			0.00			0.00		0.000	0.000	INR ero Only
5.06	SUPPLY- GIS: SPARES: 220KV, L-BEND	item77	1	Set			0.00			0.00		0.000	0.000	INR ero Only
6.01	SERVICES- GIS: SUPERVISION OF ERECTION: 220KV, SF6 GIS BAY MODULE	item78	11	SET			0.00			0.00		0.000	0.000	**INR Zero Only**
6.02	SERVICES- GIS: TESTING & COMMISSIONING: 220KV, SF6 GIS BAY MODULE	item79	11	SET			0.00			0.00		0.000	0.000	INR ero Only
6.03	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF 1 PHASE, SF6 TO AIR BUSHING	item80	24	NO.			0.00			0.00		0.000	0.000	INR ero Only
6.04	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF 1 PHASE, SF6 TO AIR BUSHING	item81	24	NO.			0.00			0.00		0.000	0.000	INR ero Only
6.05	SERVICES- GIS : 400KV, SUPERVISION OF ERECTION OF 1 PHASE GAS INSULATED BUS DUCT	item82	350	MTR			0.00			0.00		0.000	0.000	INR ero Only
6.06	SERVICES- GIS : 400KV, TESTING & COMMISSIONING OF 1 PHASE GAS INSULATED BUS DUCT	item83	350	MTR			0.00			0.00		0.000	0.000	INR ero Only
6.07	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS CABLE TERMINATION ENCLOSURE, INDOOR TYPE	item84	6	NO.			0.00			0.00		0.000	0.000	INR ero Only
6.08	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS CABLE TERMINATION ENCLOSURE, INDOOR TYPE	item85	6	NO.			0.00			0.00		0.000	0.000	INR ero Only

6.09	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS CABLE TERMINATION ENCLOSURE, OUTDOOR TYPE	item86	6	NO.			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
6.10	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS CABLE TERMINATION ENCLOSURE, OUTDOOR TYPE	item87	6	NO.			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
6.11	SERVICES- GIS: SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	item88	1	Lot			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
6.12	SERVICES- GIS: FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	item89	1	Lot			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
6.13	SERVICES- GIS: INSULATION CO-ORDINATION STUDIES GIS SYSTEM COMPLETE	item90	1	LOT			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
7.01	SERVICES- GIS : REFERENCE UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	item91	10	MAN-DAY			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
7.02	SERVICES- GIS : REFERENCE UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	item92	10	MAN-DAY			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
7.03	SERVICES- GIS : REFERENCE UNIT OF GIS INDIVIDUAL ITEM/ EQUIPMENT - HIRING CHARGES OF HV TEST KIT WITH OPERATOR	item93	1	LOT			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
8.01	Service: Training- Training in Design, Manufacturing and Testing of equipment/ GIS being supplied at manufacturer's works/ facility	item94	120	MAN-DAY			**0.00**			**0.00**		**0.000**	**0.000**	INR ero Only
Total in Figures												**0.000**	**0.000**	ero Only
Quoted Rate in Words		**INR Zero Only**												

845322/2022/TBG-TB_HVDC

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT
NOIDA

DOCUMENT NO.	TB-PBTU-DTL-SBJM-GIS	Rev 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	**SS**	**SKS**	**SKS**
TITLE 220kV Gas Insulated Switchgear with its accessories		SIGN	-SD-	-SD-	-SD-
		DATE	19.05.2022	19.05.2022	19.05.2022
		GROUP	TBEM		
		WO No.			

CUSTOMER	Delhi Transco Ltd. (DTL)
PROJECT	Pre Bid Tie up for, Design, Engineering, Supply, Erection, testing & Commissioning of 220 kV GIS at 220 kV Subzi Mandi Substation on turnkey basis

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Remarks: Bidder to note that data and details of Guaranteed Technical Particulars shall not be reviewed during Technical Evaluation/ Review, hence compliance of Guaranteed Technical Particulars in line with Technical Specification has to be ensured by the bidder.

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8. OTHER GENERAL REQUIREMENTS
9. DRAWINGS / DOCUMENTS REQUIRED FOR ENGINEERING MANUFACTURING CLEARANCE
10. TYPE TESTING
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12. SITE SERVICES
    a. SUPERVISION AT SITE
    b. TESTING & COMMISSIONING
13. TESTING KITS, TOOLS & TACKLES
14. SPARES
15. PACKING AND DISPATCH
16. EXCLUSION FROM BIDDER'S SCOPE

This document covers broader guideline for bidder's scope of supply & services. The same shall be prevailing on all other section of technical specification.

1. SCOPE

This technical specification covers the requirements of (1.) design, type testing, engineering, fabrication, manufacturing, shop assembly, inspection and testing at manufacturer's works, proper packing, supply and delivery to project site, (2.) supervision of material reconciliation, installation / erection, (3.) execution of site testing & commissioning along with necessary kits, tools & equipment , putting GIS with LCC & its Accessories into successful operation complete with all materials, support structures, anchoring bolts, chemical anchor, accessories, commissioning spares & maintenance spares, special spanners, special tools & tackles, any specific required ancillary services, SF6 gas for first filling & spare etc. including design studies, training of BHEL / Customer personnel for offered GIS & its Accessories complete in all respects for efficient & trouble-free operation mentioned under this specification.

This section covers bidder's scope for GIS with LCC & its Accessories. The offered GIS with LCC & its Accessories shall comply with the Section-1, 2 & 3 of technical specification.

The complete technical specification comprises of following sections:

Section-1	:	Scope, Project Specific Technical Requirements & Bill of Quantities including scope matrix
Section-2	:	Equipment Specification under scope of Supplies
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)
Section-4	:	Annexures Annexure A- Compliance Certificate Annexure B- Schedule of Technical Deviations

The following order of priority shall be followed. In case of conflict between

requirements specified in various documents, the more stringent one shall be followed. BHEL/Customer concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations
2. Section-1(PART-A) Standard Scope Matrix
3. Section-1(PART-B)
4. Section-2
5. Section-3

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL will address the bidder's listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL of their interpretation. In case bidder fails to convey the same prior to award, BHEL decision on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), if any.

Please note, any deviation not specifically brought out in Annexure-B (Schedule of Technical Deviations) **shall not be admissible** for any time and commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

2. SPECIFIC TECHNICAL REQUIREMENTS

Please refer Section-1(PART-B) of technical specification.

3. NOTE FOR BILL OF QUANTITIES

1. SF6 gas for initial installation of complete GIS System, including wastage during installation, testing and successful commissioning shall be deemed included in the bidder's scope.
2. The offered GIS with LCC & its Accessories shall be complete in all respect in compliance to technical specification and relevant IS / IEC / IEEE standards as applicable. Any other equipment/material required to complete the specified GIS scope of work are inclusive of bidder's scope of supply & services.
3. All essential and desirable accessories are deemed inclusive of offer i.e. and not limited to Gas Monitoring Devices, Pressure Switches, PD sensors, Pressure relief device, insulator, expansion joint/ flexible, bellows/ compensators like lateral mounting units, Axial compensators, Parallel compensators, tolerance compensators and vibration compensators etc. complete in all respect.
4. Total contract value may vary up to ±30% at contract stage.
5. Any Item not quoted mentioned "**Not Applicable**" in bid price schedule and found applicable as per technical specification and system requirement shall be supplied free of cost by bidder without any time / cost implication to BHEL / Customer.
6. Length & route of GIB is purely indicative and same shall be finalized during detailed engineering stage.
7. BHEL reserve rights to amend Bay sequence during contract stage, no separate claim shall be admissible in this regards.
8. Supply scope of Testing & Maintenance Equipment – Scope of supply of following Equipments shall be applicable only if covered in BOQ / BPS.
    a. SF6 Gas leakage detector
    b. Gas filling and evacuating plant: (Gas Processing unit)
    c. SF6 gas analyser
    d. Portable Partial Discharge(PD) monitoring system
    e. Online Partial Discharge Monitoring System
9. Main Bus 1 / 2 ~~/ Transfer Bus~~ etc. Gas Insulated Bus Bars running across the length of the switchgear to interconnect each of the bay modules (as per layout) and necessary interfaces (as applicable under the technical requirement) is deemed inclusive in the scope. The same may or may not be indicated with

break-up in BOQ / BPS.

Remark: BPS: Bid Price Schedule

4. NOTES ON MODE OF MEASUREMENT

1. The price of Bus-duct inside the GIS hall (upto **outer** wall face of GIS Hall) shall be integral part of the respective bay module and it will not be paid separately. However, the payment of bus-duct for outside the GIS hall along with support structure shall be paid as per running meters in line with provision of Technical Specification & Bid Price schedule.
2. In the case of outdoor type GIS, Gas Insulated Bus Duct (GIB) length of bus duct outside the GIS BAY MODULE shall be considered for mode of measurement from the end of Bay equipment (VT, LA etc.) to end equipment (SF6 to air bushing / SF6 to oil bushing/ Cable connection module etc.).
3. Any change in bay pitch (distance between bays): In a case where shifting of GIS bays shall be called by BHEL (during contract stage) due to layout requirement / cost optimization / revision / change in civil architectural requirement or due to expansion joint requirement in the GIS building, Bidder to incorporate the same with full compliance of technical requirement. Payment equivalent of BPS / BOQ item under head "Gas Insulated Bus Duct" shall be operated for additional length of Main Bus, subject to such shifting is not attributed to bidder.

5. SUPPORT STRUCTURE & HARDWARES (INCLUDING STRUCTURE STEEL)

Structural Steel, Support Structure & Hardwares (required for installation of complete GIS system with LCC & its Accessories etc.) are deemed inclusive of bidder's scope of supply. The same may or may not be indicated with break-up in BOQ / BPS.

All steel structure members shall be hot-dip galvanized after fabrication (excluding floor embedded items for which standard practice is to be followed). All field assembly joints shall be bolted. Field welding shall generally not be acceptable. Noncorrosive metal or plated steel shall be used for bolts and nuts throughout the work.

The minimum weight of the zinc coating shall be 610 gm/sq.m and minimum average thickness of coating shall be 86 microns for all items having thickness 6mm

and above and 900 gm/sq.m for coastal area (if defined in Section-1B / Section-2 of technical specification) For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq.m minimum and **900 gm/sq.m for coastal area** (if defined in Section-1B / Section-2 of technical specification).

1. Lattice / Pipe structure Materials for support of GIS, Bus Ducts, SF6 to oil bushing/ SF6 to cable connection and SF6 to air bushing/ connection including Anchor Fastener Bolts, Foundation Bolts, Base Plate / Channel / Metallic / Structural Member for seating of GIS system, all floor and wall Embedded Items, wall crossing arrangements, Rails and/ or other items structural items as required. Manufacturer shall provide suitable foundation channels and anchor bolts to support the switchgear assemblies. All mounting bolts, Anchor Fasteners, foundation bolts, nuts and washers, equipment fixing hardware shall be provided to fasten the switchgear base frames to the foundation channels as applicable
2. The GIS Equipment shall be complete with all necessary supports, ladders, galleries, staircases, catwalks, movable platforms or walkways (for accessing the equipment above two meters for maintenance and operation), mechanism cabinets, internal cable raceways etc. for each bay and it shall be of modular construction and extendable design.
3. Structural steel for complete GIS system with LCC & its Accessories is deemed inclusive in bidder's scope of supply.

6. EARTHING MATERIALS OF GIS

Bidder to submit detailed calculations and layout drawings for earthing system during detailed engineering stage based on technical specification, bidder's design philosophy, IS/IEC/IEEE requirement as applicable. Bidder to provide the bill of quantity of entire GIS system with LCC & its Accessories

1. Supply of 40 mm MS ROD, 75X12 mm GI Flat, 50X06 mm GI Flat is **not in bidder's scope** of supply.
2. All other earthing materials including complete Hardwares, nut, bolts washers, lug etc. required, as per earthing design shall be in bidder's scope of supply.
3. Installation / Erection of earthing will be done by BHEL team under the supervision of bidder/manufacturer, as per manufacturer's design.

7. SCOPE FOR CABLES

1. Power, control & instrumentation cables for **Cabling** (1.) within GIS, (2.) GIS to LCC, (3.) LCC to LCC shall be deemed inclusive in bidder's scope of supply.
2. Scope includes for completeness for GIS system with LCC & its Accessories
3. Cabling between LCC to LCC shall be applicable if required in bidder's design philosophy.
4. Cables required for bidder supplied GIS sub-system i.e. condition monitoring system (Gas monitoring system, PD monitoring system etc) are to be supplied by bidder as complete system.
5. Necessary Cable Lug, Glands & shroud etc. required for installation of bidder's supplied cable are deemed inclusive in bidder's scope.
6. Bidder to provide detailed "Bill of Quantity" during detailed engineering stage. Cabling & termination schedule for the same shall be provided by successful bidder along with AS BUILT drawing during contract stage.
7. Power Cable TB's (for both AC & DC incoming feeder cables) shall be suitable for termination of requisite cable.

8. OTHER GENERAL REQUIREMENTS

Other general requirements GIS with LCC & its Accessories shall be as follows,

1. Guaranteed Technical Particulars: Bidder to submit detailed GTP in line with technical specification during contract stage for review and approval. GTP & drawings submitted with technical bid shall only be reviewed during contract stage only. Bidder to please note, deviations / conflict if any please be mentioned in schedule of technical deviations only.
2. The positioning of the circuit breaker in the GIS shall be such that it shall be possible to access the circuit breaker of any feeder from the front side for routine inspection, maintenance and repair without interfering with the operation of the adjacent feeders.
3. The physical layout shall ensure free movement of the SF6 Gas Cart and easy access to all components of the GIS for operation and maintenance purposes.
4. Bidder shall submit list of consumables with shelf life of less than six months and same shall be dispatched before commencement of erection or after clearance from BHEL/Customer whichever is earlier. No separate dispatch clearance shall be

required for consumables. Cost of the same deemed inclusive.

5. Bidder shall offer their latest type tested model to accommodate the specified & allocated space as per attached layout drawing of GIS.
6. Bidder shall conduct insulation co-ordination studies in line with IEC for establishing surge arrester rating, quantity and any other requirement for successful operation of GIS.
7. Bidder to submit Study report of VFTO generated for 400kV GIS installation.
8. Bidder shall check and ensure adequacy of system protection for successful operation of GIS. After checking of system by bidder, GIS shall be installed and if any failure, malfunction of any part occurs after/ during commissioning, same shall be replaced immediately without any extra cost.
9. Final documentation shall be submitted in hard copy (Four prints) and soft (Three CDs/DVDs)
10. In the case if CSD is specifically called in BPS / BOQ / Section-1(PART-B) of technical specifications, the same should have display facility at the front for the display of settings and measured values. In case where CSD does not have complete display facility for settings and measured values, bidder to supply one number laptop PC with pre-installed, licensed software for each site. Special cable required for integration is deemed inclusive in bidder's scope.
11. Bidder to submit all supporting documents in English. If document submitted by bidder is other than English language, self-attested English translated document should also be submitted.

9. DRAWINGS / DOCUMENTS FOR MANUFACTURING CLEARANCE

The drawings/ documents, as follows shall be used for providing technical clearance for manufacturing of GIS and furthermore, it shall be used for delay analysis, if any, from bidder. The first drawing submission will be counted from the date of submitting reasonably correct drawings.

Sl. No.	Overall Drawings approval required in Cat I /Cat II
LOT-1	
1	GIS- Gas Schematics with Single Line Diagram (Including CT VT Parameters)
2	GIS- Guaranteed Technical Particulars (Including all GIS equipment)

3	GIS- Layout Plan & Section
4	GIS- Interfacing Drawings for Cable Connection Module / SF6 to Air Bushing / SF6 to Oil Module (as applicable under scope) with Guaranteed Technical Particulars
5	GIS- Equipment Layout with Earthing philosophy
6	GIS- Type Test Reports (Including all GIS equipment)
7	GIS- Quality Assurance Plan & Inspection Test Schedule
LOT-2	
8	GIS- Earthing Design, philosophy, Layout
9	GIS- Secondary Engineering Base Design
10	GIS- Control Schematics for GIS and Local Control Cabinet
11	GIS- Maintenance Equipment Catalogue with Guaranteed Technical Particulars, test reports
12	GIS- Quantification for main Items, Spares, Consumables
13	GIS- Civil Design Specification with Foundation Loading Diagram (Including interfacing details)
14	Other documents as per Technical Specification / BPS / BOQ shall be finalized during detailed engineering stage.
OTHER	
15	GIS- 3D OGA Drawing (3D-Model with complete editable data base) compatible with Autocad & Primtech for complete GIS & its accessories.
16	Manuals on unloading, safe storage, transportation, installation, testing, commissioning, routine check, preventive maintenance

10. TYPE TEST

Please refer Section-1(PART-B) and Section-2 of technical specification for the details of type test requirement. All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine & acceptance tests in accordance with requirements stipulated under respective sections of technical specification.

11. QUALITY PLAN

Bidder to follow valid customer approved (1.) Manufacturing Quality Pan, (2.) factory acceptance test (FAT) procedure & (3.) Site acceptance test (SAT) procedures, as per Customer procedure. In case the bidder doesn't have Customer approved Quality Plan, it will be the bidder's responsibility to get its Quality Plan approved from the ultimate Customer within 30 days from the date of issue of after award of LOI / PO whichever is earlier.

All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification.

GIS and its associated materials shall be subject to inspection by BHEL/ Customer / authorized representative at bidder / manufacturing works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL. During fabrication, the equipment shall be subject to inspection by BHEL/ Customer or by an agency authorized by BHEL/ Customer to assess the progress of work as well as to ascertain that only quality raw material is used.

12. SITE SERVICES

Site service activities shall be carried out at in stages as per requirement or front availability at site, and hence multiple visits for completion of work are envisaged as per site requirements hence any claim in this regards shall not be admissible on account of multiple mobilization or idling during project execution stage.

12.1. SUPERVISION AT SITE

1. Supervision of complete installation / erection of GIS with LCC & its Accessories are in the scope of bidder.
2. Scope also includes verification of materials for proper storage with due

instructions/ training to site persons for long storage.

3. Standard storage instruction manual specifically specifying the item detailed with details of type of storage.
4. Supervision for reconciliation and spares / accessories and handing over to customer.
5. Final documentation

12.2. TESTING & COMMISSIONING

1. The complete GIS System shall be subjected to the site tests as per technical specifications, IEC-62271-203. Bidder to submit site acceptance testing (SAT) procedures and get the same approved from BHEL / Customer before carrying out the site testing at site.
2. Carrying out successful HV/ Power Frequency Testing of GIS as per IEC shall be in scope of bidder, which includes HV test kit with operator, accessories & tools required for completion of HV testing. Bays may be commissioned separately.
3. BHEL shall provide free support at site for HV Test Kit i.e. it's unloading, assembling of HV test kit, dismantling & loading back on carrier.
4. Complete Field testing and commissioning of GIS system with LCC & its Accessories are under the scope of Bidder.
5. Bidder supplied special equipment, T&P if required OEM supervision, the same is to be arranged by bidder, cost of the same shall be deemed inclusive of respective item.
6. Bidder/ OEM shall coordinate with manufacturers of other equipment wherever required and shall freely and readily supply all technical information for this purpose as and when called for.
7. ETC work schedule for all the GIS may vary according to readiness of site. Respective dates for the commencement of erection, testing and commissioning activities of GIS shall be communicated to manufacturers from time to time as per the readiness of site.

13. TESTING KITS, TOOLS & TACKLES

1. All the Instruments/ Testing kits including HV Test Kit, SF6 Gas handling

Equipments required for successful installation, testing, commissioning, maintenance of offered GIS are to be arranged by bidder on **returnable** basis. Cost of the same shall be deemed inclusive in the offer.

2. Special tools & tackles for installation, maintenance, testing & commissioning of GIS shall be in bidder's scope, it shall be brought at site on **returnable** basis only.
3. The general Tools and Tackles shall be provided by BHEL, list of the requirement i.e. general tools-tackle, spanners, gauges, slings and other lifting devices, crane, welding machines, drills, general instruments and appliances necessary for the installation of GIS is to be submit by bidder along the technical bid. In case bidder fails to convey the same along with technical bid, BHEL decision on interpretation of general tools tackle shall be considered final and any tools & tackles required shall be brought at site by bidder without any claim.
4. Bidder to furnish detailed BOQ for non-returnable special Tools and Tackles, if applicable along with unit prices to be handed over to ultimate customer. The prices for the same shall be considered during evaluation.

14. SPARES

1. Any equipment which is not supplied as main equipment or part of main equipment, mandatory spare for that is not applicable.
2. In case contractor offers circuit breaker, dis-connector, current transformer, SF6/Air Bushing etc. under main equipment of higher rating than equipment rating specified in the specifications, the mandatory spare of same higher rating offered by contractor identical to main equipment offered in the package shall be required to be supplied against spares without any cost implication.
3. The Mandatory Spares shall be included in the bid proposal by the bidder. The prices of these spares shall be given by the Bidder in the relevant schedule of Bid Price Schedule and shall be considered for evaluation of bid. It shall not be binding on the Employer to procure all of these mandatory spares.
4. The bidder is clarified that no mandatory spares shall generally be used during the commissioning of the equipment.
5. Start-up & Commissioning spares are included in bidder’s scope of supply and shall be included in the base price. Adequate stock of start-up & commissioning

spares shall be made available at the site such that the start-up and commissioning of the equipment /systems, performance testing and handing over the equipment/ systems to the Purchaser can be carried out without any hindrance or delays. The unutilized Start-up & Commissioning spares brought for commissioning purpose by bidder shall be taken back by the bidder.

6. Wherever spares in BPS / BOQ/Technical Specification have been specified as "each type/each rating/each type & rating": If the offered spare/spares is sufficient to replace the respective main equipment of all types/ratings, then such offered spare/spares shall be acceptable. It implies that common spare/spare set fulfilling the spare requirement of all types/ratings shall also be acceptable, provided it is configurable at site itself without special assistance of OEM.
7. Mandatory Spares, wherever mentioned, are envisaged for the equipment/items being supplied under the main equipment heads under present scope meeting the requirements of Technical Specifications. The component/sub-component of an equipment/item specified in BPS / BOQ under Mandatory Spare, which is not applicable as per the offered design of respective main equipment, shall not be referred to.
8. Bidder to submit price break-up of spares during tender stage. It shall not be binding on the BHEL to procure all of these mandatory spares.
9. Bidder/ vendor shall ensure the availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply. Bidder shall give a notice of at least one year to the Customer & BHEL (both) before phasing out the products/spares to enable the owner for placement of order for spares and services.

15. PACKING AND DISPATCH

1. The equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. Packing of the equipment shall be suitable for long storage (minimum 1 year).
2. The GIS transport units shall be shipped in the largest factory assembled units within transport and loading limitations and considering handling facilities on site to reduce the erection and installation work on site to a minimum. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner.

3. Each individual piece to be shipped, whether crate, container or large unit, shall be marked special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'Owner's particulars', 'PO no.' etc., and other details as per purchase order & technical specification.
4. The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains and high ambient temperature.
5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the equipment of which each gas section shall be sealed and pressurized prior to shipping. Dry nitrogen/air or dry SF6 gas (in full compliance to technical requirement) shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.
6. All blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site shall be provided. Any seals, gaskets, `0' rings, etc. that will be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Vendor to provide quantity of components accordingly considering permanent installation and commissioning.

16. SPECIFIC- EXCLUSIONS (NOT IN BIDDER'S SCOPE)

The following items are specifically excluded from the bidder's scope of supply & services, irrespective of the same if covered under any section of technical specification other than Section-1 (PART-B). If specific requirement mentioned in the Section-1(PART-B) of technical specification shall overrule this specific exclusion.

1. Any scope of supply / services mentioned in Section-2 or Section-3 of technical specification but not having any relationship with GIS, LCC & its Accessories and not covered in Section-1(PART-B) or BPS / BOQ shall be deemed excluded from bidder's scope.
2. Installation / Erection of GIS with LCC & its Accessories except supervision work.

3. Cable laying & terminations, however supervision work & termination of special cables shall be in bidder's scope.
4. Open & Closed stores at site. (Bidder to provide space requirement in tech bid)
5. Local transportation/ conveyance for bidder's engineers shall be arranged by BHEL between local stay and site.
6. Office assistance shall be provided BHEL including sitting facility etc.
7. Receipt & unloading of material at site except supervision work
8. Terminal connector for SF6 to Air Bushing to conductor or any other interfacing equipment.
9. Watch & Ward of GIS material at BHEL Store
10. Civil Works i.e. GIS Hall, civil works requirement for GIS System. (Please refer clause "Structure-Steel" for bidder's scope of supply)
11. EOT crane, Air Conditioning & Ventilation System, Illumination System & Fire detection & alarm system, however complete input shall be provided for EOT and other system
12. Control Relay & Protection Panels, Numerical Relays, Bus Bar Protection Panel, SAS & ECS system, ACDB, DCDB, Battery & Charger
13. Earthing material i.e. 40 mm MS Rod, 50X6 GI Flat & 75X12 GI Flat for earthing
14. Outdoor AIS Equipments
15. Power & Control cable beyond LCC
16. BHEL / Customer / BHEL appointed 3rd party inspector travel, lodging & boarding charges during testing / inspection.

Rev Number	Date	Initiated by	Reviewed by	Approved by	Updates
Rev.0	19 Feb 2022	JAIK	SKS	AG	
Rev.1	04 March 22	JAIK			Clause 4.1 revised Clause 3.9 added Clause 5 900 gm/sq.m for coastal area
Rev.2	09 March 22	JAIK			Clause 5 updated (yellow highlight)

Specific Technical Requirements, Bill of quantity and project details

This technical specification is required for Pre-bid tie-up before participation in the following tender:

Name of the Customer	Delhi Transco Ltd. (DTL)
Name of Main Contractor	Bharat Heavy Electricals Limited
Name of the Project/ Tender	Design, Engineering, Supply, Erection, testing & Commissioning of 220 kV GIS at 220 kV Subzi Mandi Substation on turnkey basis
Locations	220 Subzi Mandi Substation, New Delhi (India)

In case of any discrepancy between Section-PROJECT, Section- GTR and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections. In case of any discrepancy between Section-GTR and individual sections for various equipments, requirement of individual equipment section shall prevail.

[1] SPECIFIC TECHNICAL PARAMETERS

1. Please refer **Section 1/ Section 2** for Specific Technical Parameters.

[2] BILL OF QUANTITIES

1. Please refer following Annexures for Bill of quantities: **Annexure- BOQ_SBJM_220kV**
2. During tender stage, no. of GIS bays may vary and hence it shall be finalized after receipt of firm order from Customer.

[3] SPECIFIC TECHNICAL REQUIREMENTS

1. Please follow Project specific requirements, as detailed in document **Annexure: Section 1: Project.**

2. Equipment Specification of GIS shall be as per **Section-2.**

[4] OTHER TECHNICAL REQUIREMENTS for GIS WITH ITS ACCESSORIES

1. Factor of safety for design of equipment structures and foundations shall be as below:

    a. Factor of safety for design of equipment structures (lattice type) shall be 2.0 under normal condition and 1.5 under short-circuit condition.
    b. The tower and equipment foundations shall be checked for a factor of safety of 2.2 for normal condition and 1.65 for short circuit condition against sliding, overturning and pullout. The same factors shall be used as partial safety factor over loads in limit state design also.

2. LT Auxiliary Supply

a.	AC	415 V (± 10%), 50Hz (± 5%), 3 phase, 4 wire solidly earthed
		240 V (± 10%), 50Hz (± 5%), 1 phase, 2 wire solidly earthed
b.	DC	190 V to 240 V, DC, 2 wire, isolated
		50 V, DC, 2 wire, positive earthed

[5] TECHNICAL QUALIFYING REQUIREMENTS

The Technical Qualifying Requirement/ criterion shall be as per **Annexure-Technical Qualifying Requirement.**

Bidder to submit complete supporting documents required for technical qualifying requirement along with technical bid.

[6] TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

The offered GIS equipment shall conform to the type tests as per IEC-62271-203. Contractor shall submit type test reports for the following type tests & additional type tests.

1. Tests to verify the insulation level of the equipment and dielectric test on auxiliary circuits
2. Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit
3. Tests to prove the ability of the main and earthing circuits to carry the rated peak and rated short time withstand current.
4. Tests to verify the making and breaking capacity of the included switching Devices.
5. Tests to prove the satisfactory operation of the included switching devices.
6. Tests to prove the strength of the enclosures.
7. Gas tightness tests.
8. Tests on partitions.
9. Tests to prove the satisfactory operation at limit temperatures
10. Tests to assess the effects of arcing due to internal fault
11. Verification of the degree of protection of the enclosure
12. Tests to prove performance under thermal cycling and gas tightness tests on Insulators.
13. Additional tests on auxiliary and control circuits
14. Reactor current switching test for Reactive Current switching capability as per Clause 6.4.1.
15. Test to demonstrate the Power frequency withstand capability of breaker in open condition at lock out pressure
16. Electromagnetic compatibility tests (if applicable)
17. Radio inference voltage tests

The test reports of the above type tests for GIS (including type test report on Circuit breaker, Disconnect Switch, Grounding switches, Current and Voltage transformers as per relevant IEC and type tests of SF6/ Air & Oil bushing as per IEC 60137, if applicable, shall be submitted for approval as per **Section-3: General Technical Requirement, Section-2: Equipment Specification.**

The validity of type test reports shall be as per the latest CEA guidelines for the validity period of type test(s) conducted on major electrical equipment in Power Transmission system. In case

the item/equipment is not listed in the CEA guidelines, the validity of the respective items/ equipment shall be as per TS.

Further, in the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes or due to non-compliance with the requirement stipulated in the Technical Specification or any/all type tests not carried out, same shall be carried out without any additional cost and delivery implication to BHEL/ customer.

Note:
Type test report shall be reviewed for approval in detailed engineering stage only. However, for evaluation purpose, the test reports are to be submitted along with the technical bid.

SECTION 1:

PROJECT

SECTION : 1

PROJECT

1.0 GENERAL

Preamble:

1.1 Delhi Transco Ltd. hereinafter termed as DTL or Owner/Purchaser is a company incorporated under Company Act 2013, fully owned by govt. of NCT of Delhi.

1.2 Delhi Transco Ltd. (DTL) is State Transmission Utility and responsible for Bulk Power Transmission of Electrical Energy in National Capital Delhi.

1.3 Delhi Transco Ltd. (DTL) is now remodeling its 220kV AIS Substation at Subzi Mandi, Delhi (India) to Gas Insulated Substation at 220 kV Level.

2.0 INTENT OF SPECIFICATION:

2.1 The specification covers the design, engineering, manufacture, fabrication, testing at manufacturers works, delivery, unloading at site, storage, erection, testing and commissioning at site of the complete 220kV switchyard including indoor SF6 gas insulated metal enclosed switchgear (GIS), 100 MVA Power Transformers with fire protection system (NIFPES), Substation Automation with Relay & Protection, CCTV and remote monitoring, optical fiber equipments & Communication (Converter) Equipments, FOTE, associated civil works, internal roads, drains, necessary buildings etc and other electrical and mechanical auxiliary systems on turnkey basis. Complete dismantling of 220 kV and 11 kV equipments, transformers, Busbars, Gantries, support structures , control panel , battery bank ,battery charger , cables and other allied associated accessories in existing AIS yard and control room building of 220 kV Substation Subzi Mandi and transportation of the same to any DTL site/store. Connection of 220 kV GIS with transformers through SF6/air bushings, SF6 duct etc. The Bus Duct/cable connection should be such that it is possible to remove transformer for repair/maintenance conveniently. The Scope of work also covers connection of 33kV output of 100MVA Transformer with existing 33kV GIS via cables of suitable size and run and complete integration of existing 33 kV GIS system with new SAS system. The existing 33kV GIS have 13 bays of Schneider Make. Bidder shall also ensure GIS compatibility for line feeder/cable termination and provide the ancillary equipment required for the same. 11kV Cable (from Metering Cubicle onward) inside the substation and room for Discom (if required) shall be in the scope of Bidder.

2.2 The supply will include all supporting structures, auxiliary equipments, mechanical linkages, hydraulic piping (if applicable) for control devices with pumps, SF6 gas piping, auxiliary circuits wiring, interlocking devices, current and voltage transformers, cable end boxes and SF6 bus ducts.

2.3 It is the intent of this specification to describe primary features, materials, and design & performance requirements and to establish minimum standards for the work.

2.4 The specification is not intended to specify the complete details of various practices of manufactures/ bidders, but to specify the requirements with regard to performance, durability and satisfactory operation under the specified site conditions.

3.0 SCOPE OF WORK

The scope of work covers remodelling of 220 kV AIS into GIS at 220 kV Substation Subzi Mandi including Design, Engineering, Supply, Erection, Testing & Commissioning of 220 kV GIS and other equipments along with associated civil works and automation on turnkey basis. As there is very limited space available at Subzi Mandi therefore complete shutdown of the existing substation has been planned for the subject work. The connected load would be shifted to upcoming 220kV Substations Timarpur and Dev Nagar by respective DISCOMs.

The scope of work broadly covers the following: -

1. Complete dismantling of 220 kV and 11 kV equipments, transformers, Bus Bars, Gantries, support structures, control panel, battery bank, battery charger, cables and other allied associated accessories in existing AIS yard (except existing 33 kV GIS), store room, switchgear room, control room building at 220 kV Substation Subzi Mandi and transportation of the same to any DTL site/store.
2. The existing ground level of substation is down compared to outside road level. Therefore, as per site requirement raising of ground level of approx 01 meter by filling soil.
3. One no. 100 MVA Power Transformer after dismantling will be utilized at the remodelled substation in the new arrangement. The other 100MVA which is outlived needs to be shifted to DTL Scrap store/DTL site. Also includes Supply, ETC of 02 no. new 100 MVA power transformer.
4. Dismantling of both 100MVA Transformer foundations and construction of new foundations for 4 no. 100MVA Transformers (1 no. old 100MVA Transformer + 2 no. new Transformers+ 1 no. Transformer for future use).
5. Dismantling and Re-erection of 220 kV Line gantry after land filling.
6. Construction of 220 kV GIS cum control room building including office space, conference hall, workshop etc as per tentative layout plan. With provision space for 3 no. 220 kV Future bays.
7. 220 kV GIS with 11 no. 220 kV GIS bays (4 no. 100MVA Transformers + 6 no. Feeders + 1 B/C)
8. Termination of four 220kV circuits (2 no. O/H and 2 no. U/G cable) into 220kV GIS via Air to SF6 Bushing and 02 no. 220 kV GIS feeders bays are for future which shall be connected through indoor cable end termination.
9. Connection of 33kV output of 100MVA Transformer with existing 33kV GIS via cables of suitable size and run and complete integration of existing 33 kV GIS system with new SAS system.
10. Erection of 33 kV GIS building for future use as per tentative layout.
11. Complete civil and including raising of ground level of approx 01 meter by filling soil.
12. Complete substation automation work of 220kV GIS and integration in SAS of existing 33kV GIS.
13. Any petty work required for completion of job.

The summary of vital scope of work is as under:-

Equipment	Rating	Quantity	Remarks
Gas Insulated Switchgear	220kV	11 No. Bays	Double Bus Bar; Transformer Bay: 4 Nos (including one spare). Feeder Bay: 6 No. (including two spare feeders)- 4 nos. O/D & 2 nos indoor terminations. Bus Coupler Bay: 1 No.
	33kV	Existing Schneider Make 33kV GIS (13 bays) is to be utilized	33kV
Power Transformer	220/33kV 100MVA	2 No. (new)	2 new and one existing is to be utilized.

I. 220kV SYSTEM

The 245kV SF6 gas insulated switch gear shall have double bus bar arrangement with the following bays:

S. No	Bay type	Number of bay(s)
1	Transformer/ Incomer Bays	04
2	Bus-coupler Bay	01
3	Feeder Bays	6
4	Total	11

There shall be provision for 3 no. future bays. The SF6 gas insulated switchgear rated for 220kV, 3-phase, 50 HZ shall be of the indoor metal-enclosed type, comprising of following items:

(A) Double bus bar arrangement, 3-phase/three 1-phase Isolated Unit, 245kV, 2500A SF_6 gas insulated, metal enclosed bus bar, each bus comprising of:

a. Bus bar enclosures running along the length of the switch gear to interconnect each of the circuit breaker bay modules in double main bus system.
b. Three voltage transformers/PTs.
c. 3- phase, single pole, group operated isolator/disconnector switches, complete with manual and motor driven operating mechanisms.
d. Two 3-phase, single pole, group operated safety grounding switches, complete with manual and motor driven operating mechanisms.
e. GIS duct with gas monitoring devices, barriers, pressure switches, UHF based partial discharge measurement sensors etc. as required.
f. Local control cubicle (if required).

(B) 245kV, Bus Coupler bay module, each comprising of :

a. One 2500 A, 3-phase, SF6 gas insulated circuit breaker, complete with operating mechanism.
b. Three 5-core multi ratio, single phase current transformers
c. Two 3- phase, single pole, group operated isolator switches 2500A, complete with manual and motor driven operating mechanisms.
d. Two 3-phase, single pole, group operated safety grounding switches, complete with manual and motor driven operating mechanisms.
e. GIS duct with gas monitoring devices, barriers, pressure switches, UHF based partial discharge measurement sensors etc. as required.
f. Local Control Cubicle (if required).

(C) 245kV, Transformer Circuit Breaker Bay Modules for 100 MVA 220/33/11KV Power Transformer Bay, each comprising of:

a. One 1600 A, 3-phase, SF_6 gas insulated circuit breaker, complete with operating mechanism.
b. Three 5-core multi ratio, single phase current transformers.
c. Three 3-phase, single pole, group operated isolator switches (1600A), complete with manual and motor driven operating mechanisms.
d. Three 3-phases, single pole group operated safety grounding switches, complete with group operated manual and motor driven operating mechanisms.
e. Three single phase SF_6 ducts for connection with power transformer through SF6/Air bushing along with support structure.
f. GIS Bus duct with gas monitoring device, barriers, pressure switch, UHF based partial discharge measurement sensors etc as required.
g. Local control cubicle (if required).

(D) 245kV, Transmission Line Feeder Circuit Breaker bay modules, each comprising of:

a. One 1600 A, 3-phase, SF6 insulated circuit breaker, complete with operating mechanism.
b. Three 5-core multi ratio, single phase current transformers.
c. Three 3-phase, single pole, group operated isolator switches (1600A), complete with manual and motor driven operating mechanisms.
d. Two 3-phases, single pole group operated safety grounding switches, complete with manual and motor driven operating mechanisms.
e. One 3-phase, single pole, high speed fault make grounding switch, complete with group operated manual and motor driven operating mechanisms.
f. Three, 3-core, single phase voltage transformers/ PTs with 3-phase, single pole, group operated isolator switch, complete with manual and motor driven operating mechanisms.
g. Three SF_6 type Surge Arrestor (single phase).
h. GIS duct with gas monitoring device, barriers, pressure switch, UHF based partial discharge measurement sensors etc. as required.
i. Local control cubicle (if required).

(E) 245kV, 1600A, SF6 Gas insulated Bus Duct (GIB) for Transformer/ Line feeder modules outside GIS hall with support structure (along with Gas monitoring devices, barriers, pressure switches UHF based partial discharge measurement sensors etc. as required) and SF6/Air bushing for interconnecting it with respective equipment.

Scope of works also includes 216 kV, 10 kA conventional outdoor type Lighting Arrestor (L.A.), Steel for support structure, ACSR Conductor, Hardware Fittings.

The Switchgear shall be complete with all necessary terminal boxes, SF6 gas filling, interconnecting power and control wiring, grounding connections, gas monitoring equipment and piping, support structures and UHF based partial discharge measurement sensors, etc.

II. The scope includes supply, erection, Testing & Commissioning of 02 nos. 220/33/11kV, 100 MVA Power Transformer with first filling of oil along with 10% extra oil, Nitrogen injection fire prevention & extinguishing system (NIFPES), NCT's, RTCC panel, terminal connectors, control cable & power cables. The RTCC panel shall be placed inside the DTL control room or as per the requirement of site in-charge.

Also Erection, Testing & commissioning of existing one no. 100MVA Power Transformer after dismantling and its utilization at the remodelled substation in the new arrangement

III. Complete sub-station automation system based on IEC 61850 including hardware and software for remote control station, relay and protection system along with associated equipments and kiosk for following bays (bay as defined in technical specification, section _ sub-station automation):

- 220kV: 11 bays + provision of 3 future bays

The sub-station should have the provision to be controlled from a remote location and mode of communication shall be optical fiber for all voltage levels. Bidder shall provide FOTE equipments along with Tele-protection cards for remote end sub-station also. FO cable inside the substation and FODB along with patch chord at local and remote ends for successful operation are in contractor's scope. FOTE for both ends shall also have provision for eight command tele-protection and two current differential protection interface. The protection requirement shall be fulfilled by the contractor for successful commissioning. Location details to be made available during detailed engineering. Suitable Converters/provision shall be made by Contractors for commissioning of FOTE system and only 220V Battery System shall be used.

IV. Complete relay and protection system.

V. Bus post Insulators, insulator strings and hardwares, clamps & connectors, terminal connector, Conductor, earth wire and earthing materials, tubular conductor, spacers, cable supporting angles/channels, Cable trays & covers, Junction box, buried cable trenches etc.

VI. One no. 1000kVA, 11kV/433V LT Transformer having 170kVp BIL at 11kV side including bushings, accessories and first filling of oil & One no. 1000KVA, 11kV/433V LT Transformer having 95kVp BIL at 11kV side including bushings, accessories and first filling of oil.

VII. Fire Detection, Alarm & Protection for GIS room and control room building, DG Set etc. (refer Annexure-VII).

VIII. Air Conditioning System as per specification in section substation automation system.

IX. Ventilation system for 220kV GIS hall. The requirement of ventilation system shall be as per Technical Specification

X. LT switchgear.

XI. 250KVA Outdoor Silent type DG Set.

XII. 220V Batteries & Battery Chargers.

XIII. 1.1kV grade Power & Control cables along with complete accessories.

XIV. Earth mat (Measurement of resistivity is in the scope of contractor).

XV. Complete lighting and illumination of the installation. This shall include the illumination for GIS Building, control room building including street lights (if any). The specification for control room GIS building illumination shall be as per

Annexure-IV.

XVI. Provision of CCTV camera for complete supervision of 220kV/33kV GIS hall, main entrance gate of substation, battery charger room, LT room, outdoor camera for monitoring of transformers and switchyard equipments from control room as well as from remote location other than substation. The cameras should be installed in such a way that the complete substation should be visible from remote for unmanned operation. The provision of Online viewing of camera from remote substation should be made by contractor.

XVII. Special Equipments for testing and maintenance.

XVIII. Bidder shall arrange suitable provision for testing of 220kV cables after isolation from the main GIS. Provision for space for termination of cable/ Overhead line shall be kept during designing stage.

XIX. Purchaser's site office with furniture and stores are in the scope of the bidder along with adequate illumination.

XX. Bidder has to submit a 'Model' of the substation before starting actual work at site.

XXI. Mandatory Spares.

XXII. 11kV protection IEDs shall have integration with SCADA. ACDB, DCDB and battery charger shall be communicable and integrated with SCADA.

XXIII. The work to be done under this specification comprises the provision of all labour, plant, equipment and material and the performance of all work necessary for the complete installation and commissioning of switchyard. It is hereby required that the contractor should provide all apparatus, appliances, material and labour etc. not specifically mentioned or included, but are necessary to complete the entire work or any portion of the work in compliance with the requirements implied in this specification is deemed to be included in the scope of contractor.

XXIV. The scope of work shall cover in complete conformity with the specifications, the followings:-

A single line schematic of the 220kV SF6 gas insulated switchgear with double bus bar arrangement is enclosed with the specification. In case any additional equipment is required, the same should be included in the scope of the supply and the offer should be complete and comprehensive. In addition all necessary platforms, supports, ladders and catwalks etc. for operation & maintenance work shall also be supplied. A tentative layout of the switchyard is enclosed with this specification. Bidder may adopt similar arrangement or optimize the same further without affecting any of the functional requirements specified.

XXV. Any other equipment/material required for completing the specified scope.

XXVI. All civil works pertaining to foundations for transformers, accessories and NIFPES rail track, soak pit & sump pit, fire resistant wall, grating etc. shall be in the scope of bidder. The watch and ward of complete site shall be in the scope of bidder.

XXVII. The location of the site for the transformer may undergo change within Delhi if so required by the employer.

XXVIII. **Civil works** - The work shall include but not limited to the following:-

i. **Detailed survey and Soil Investigation.**

ii. **Design, Engineering and civil work for:**

a. Demolition of existing control room building, switchgear room, existing store room building , foundation of equipments including transformer foundation andboundary wall (where ever required) etc.

b. Buildings for control room and well furnished GIS hall (for 220KV & 33KV) as per details in Section civil works. 220KV GIS hall shall be provided with EOT crane and the requirement of crane shall be as per Technical Specification of GIS.

c. DTL site office (Porta cabin with furniture and AC) and store.

d. Foundation of 100 MVA Power Transformers, accessories and NIFPES including rail track, soak pit, sump pit, fire protection wall, grating etc.

e. Foundation of 1000KVA LT transformers.

f. Foundation of 250KVA DG set.

g. Foundation of 220kV Surge Arrester.

h. All civil works associated with erection of SF6 gas insulated metal enclosed switchgear including their foundation.

i. Foundation for lighting poles, panels & control cubicles of equipments wherever required.

j. RCC in foundation including earth work in excavating disposal of surplus earth PCC, RCC, reinforcement steel for structures and equipments.

k. All roads including all crossings.

l. RCC frame boundary wall with brick panneling including gate for complete substation.

m. Land Filling.

n. Site surfacing (gravelling) and anti weed treatment of complete switchyard area with provision of anti-termite treatment in control room building.

o. Cable trenches including all types of crossings (including power cable trench).

p. Substation fencing along with gates.

q. Rain Water harvesting.

r. Drainage system in the substation including storm water drainage.

s. Pump house building

t. Lighting cum lightening mast with fixtures

u. Transformer fire walls

v. Car/Sctoor Parking

w. Any other work required for functional requirement of establishment of the substation.

x. Furniture of reputed make for control room cum administrative building including other amenities.

3.1 Before proceeding with the construction work of the substation, the Contractor shall fully familiarize himself with the site conditions and General arrangements & scheme etc. Though the Purchaser shall endeavor to provide the information, it shall not be binding for the Purchaser to provide the same. The bidders are advised to visit the substation sites and acquaint themselves with the topography, infrastructure and also the design philosophy. The bidder shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the construction and successful commissioning, operation & maintenance of the substation in all respects. All materials required for the Civil and construction/installation work shall be supplied by the Contractor. The cement and steel shall also be supplied by the Contractor.

The complete design **(unless specified otherwise in specification elsewhere)** and detailed engineering shall be done by the Contractor based on conceptual tender drawings.

3.2 The Contractor shall also be responsible for the overall co-ordination with internal/external agencies, project management, training of Purchaser's manpower, loading, unloading, handling, moving to final destination for successful erection, testing and commissioning of the substation/switchyard.

3.3 Design of substation and its associated electrical & mechanical auxiliaries systems includes preparation of single line diagrams and electrical layouts for extension area, erection key diagrams, electrical and physical clearance diagrams, design calculations for Earth mat, control and protection schematics, wiring and termination schedules, civil designs (as applicable) and drawings, design of fire fighting system and air conditioning system, indoor/ outdoor lighting/illumination and other relevant drawings & documents required for engineering of all facilities under the scope of this contract.

3.4 The Bidder shall keep the provision of service bays for increasing the length of GIS room to meet the future requirement, keeping the width of the building same. GIS building size shall be frozen after considering the requirement of three nos. 220kV GIS future bays of reputed make & size.

3.5 Specific Exclusions

The following items of work are specifically excluded from the scope of the specifications for substation:

1. Road outside Boundary Wall.

3.6 Any other items not specifically mentioned in the specification but which are required for erection, testing and commissioning and satisfactory operation of the substation are deemed to be included in the scope of the specification unless specifically excluded.

3.7 Purchaser has standardized its technical specification for various equipments and works for different voltage levels. Items, which are not applicable for the scope of this package as per schedule of quantities described in Bid Price Schedule, the technical specification for such items should not be referred to.

3.8 Water based firefighting and reservoir are not envisaged.
Pump and pump house is required for evacuation of surface/rain water or water logging in substation premises, primarily for water accumulated in trenches/drains/Cellar. Moreover, Pump will also function for regulating water to water harvesting system.

4.0 PHYSICAL AND OTHER PARAMETERS

4.1 **Location of the Substation** - The location of substation is indicated below:

Name of Substation	Name of State	Nearest Railway station	Railway Head
Subzi Mandi	Delhi Region	Delhi	Northern Railways

4.2 **Meteorological data**
The meteorological data of the substation shall be handed over to successful bidder However for design purposes, ambient temperature and altitude shall be considered as 50 degree centigrade and less than 1000 mtr above MSL, respectively.

4.3 **Soil Data**
The bidder shall be responsible for carrying out the required tests and should fully satisfy himself about the nature of soil expected to be encountered prior to the submission of bid.

Any variation of soil data during detailed engineering or construction stage shall not constitute a valid reason in affecting the terms and conditions of the bid.

5.0 SCHEDULE OF QUANTITIES

The requirement of various items/equipments and civil works are indicated in Bid price Schedules.

All equipments/items and civil works for which quantities has been given in the price schedule shall be payable on unit rate basis. During actual execution, any variation in such quantities shall be paid based on the unit rate under each item incorporated in the letter of award.
Wherever the quantities of items/works are not indicated, the bidder is required to estimate the quantity required for entire execution and completion of works and incorporate their price in respective Bid price schedules.
The detailed bill of quantities of the mandatory spares with break up is given in the Annexure-I.
Bidder should include all such items in the bid proposal sheets, which are not specifically mentioned but are essential for the execution of the contract. Item which explicitly may not appear in various schedules and required for successful commissioning of substation shall be included in the bid price and shall be provided at no extra cost to Purchaser.

6.0 BASIC REFERENCE DRAWINGS

6.1 220/33kV Subzi Mandi Sub-station (DTL) is an existing AIS Substation. For 220kV, Double bus switching scheme layout arrangement shall be used. Single line diagram and layout arrangements are enclosed with the bid documents, which shall be further engineered by the bidder.

The drawings enclosed in Annexure-II shall give the basic scheme, layout of substation, substation building, associated services etc. In case of any discrepancy between the drawings and text of specification, the requirements of text shall prevail in general.

6.2 The auxiliary transformers of rating 1000KVA shall be used to feed the substation auxiliaries.
The 1000 KVA, 11/0.433 kV (170kVp - BIL) auxiliary transformer shall be connected through overhead conductor to the tertiary of any one of the 100 MVA power transformers and shall be located near the power transformer while another 1000KVA (95kVp - BIL) auxiliary transformer shall be located in LT station area and HT side shall be connected with Discom supply through 11kV HT Cable. These auxiliary transformers should not be used for construction purpose.

7.0 ORDER OF PRECEDENCE OF DIFFERENT SECTIONS OF TECHNICAL SPECIFICATION

For the purpose of present scope of work, technical specification shall consist of following sections and they should be read in conjunction with each other.

1) Section-1 : Project
2) Section-2 : Gas Insulated Switchgear GIS
3) Section-3 : General Technical Requirement (GTR)
4) Section-4 : Special Equipments
5) Section-5 : Fire Protection System

6) Section-6 : LT Switchgear
7) Section-7 : Battery and Battery Charger
8) Section-8 : Lighting System
9) Section-9 : LT transformer
10) Section-10 : Diesel Generator
11) Section-11 : Switchyard
12) Section-12 : Civil Works
13) Section-13 : Substation Automation System
14) Section-14 : Control and Relay Panels
15) Section-15 : Power and Control Cables
16) Section-16 : Visual Monitoring
17) Section-17 : Fiber Optic Terminal Equipment (FOTE)
18) Section-18 : Lightning Arrestor (LA)
19) Section-19 : Power Transformer
20) Section-20 : Nitrogen Injection Fire Prevention Cum Extinguishing System (NIFPES)

In case of any discrepancy between Section-PROJECT, Section- GTR and other technical specifications on scope of works, Section-PROJECT shall prevail over all other sections.
In case of any discrepancy between Section-GTR and individual sections for various equipments, requirement of individual equipment section shall prevail.

8.0 MANDATORY SPARES

Mandatory Spares shall be included in bid proposal by the bidder. Prices of these spares shall be given by the Bidder in relevant price schedule and shall be considered for evaluation of bid. It shall not be binding on the Purchaser to procure all of these mandatory spares.

The bidder is clarified that no mandatory spares shall be used during commissioning of the equipment. Any spares required for commissioning purpose shall be arranged by the Contractor. The unutilized spares if any brought for commissioning purpose shall be taken back by the contractor.

9.0 SPECIAL TOOLS AND TACKLES

The bidder shall include in his proposal the deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of equipment. However a list of all such devices should be indicated in the relevant price schedule. In addition to this the Contractor shall also furnish a list of special tools and tackles for the various equipment in a manner to be referred by the Purchaser during the operation of these equipment.

10.0 FACILITIES TO BE ARRANGED BY THE CONTRACTOR

10.1 For construction purpose, the Contractor shall arrange suitable electricity supply from the Distribution Utility at his own cost and in case of failure of power due to any unavoidable circumstances, the contractor shall make his own necessary arrangements like diesel generator sets etc., at his own cost so that progress of work is not affected and Employer shall in no case be responsible for any delay in works because of non-availability of power.

10.2 The contractor shall make his own arrangement for water supply at his own cost and the Employer shall in no case be responsible for any delay in works because of non-availability or inadequate availability of water.

11.0 TERTIARY WINDING (TRANSFORMER)

The tertiary winding shall be suitable for connection to LT transformer for auxiliary supply. The details of equipment associated with loading tertiary winding are enclosed as Annexure-III.

12.0 SPECIFIC REQUIREMENT

12.1 Training of Owner's Personnel
The successful tenderer shall also arrange the training of owner's/purchaser's engineers at the manufacturer's works/facility from where the equipment is being supplied for 120 man days in Design, Manufacturing and Testing of equipment being supplied. To & fro air fare including boarding and lodging shall be borne by the owner/purchaser and no separate charges for training shall be paid.

12.2 Bidder shall conduct type tests on equipments other than GIS if required in their respective section.

12.3 The equipment to be supplied for 220kV system shall be suitable for system fault current of 50 KA for 1 second as specified elsewhere in the specification.

12.4 The contractor shall place their panels i.e. Bay level units, bay mimic, relay and protection panels etc in an enclosure for 220kV in respective GIS hall. The enclosure shall be air-conditioned and requirement of air-conditioning shall be as detailed in section Sub-station Automation System.

12.5 Control, monitoring and protections (over current and open delta protections) for Auxiliary transformer and associated equipments shall be from auxiliary BCU to be provided as per section sub-station automation.

12.6 The specification of 33 kV XLPE cable required for interconnection between 33 kV side of power transformer to 33 kV GIS hall is enclosed as Annexure-V. The formation and the other details shall be finalized during detailed engineering.

12.7 As 220kV GIS are proposed to be extended in near future, the contractor shall make available all details such as cross section, gas pressure etc required to design adapter in future for extension of GIS during detailed engineering.

12.8 The bidder shall be responsible for safety of human and equipment during the working. It will be the responsibility of the Contractor to co-ordinate and obtain Electrical Inspector's clearance before commissioning. Any additional items, modification due to observation of such statutory authorities shall be provided by the Contractor at no extra cost to the Purchaser.

12.9 In Section-GTR and other technical specifications, the word 'Employer' and/or 'Owner' may be read as 'Purchaser'.

12.10 Vendor has to ensure minimum clearance in and around GIS hall to ensure proper safety, maintenance and movement for equipments and personnel.

12.11 Provision of separate /different trenches for power cable and control cable are to be made as far as possible.

12.12 The validity of type test reports shall be as per the latest CEA guidelines for the validity period of type test(s) conducted on major electrical equipment in Power Transmission system. In case the item/equipment is not listed in the CEA guidelines, the validity of the respective items/equipments shall be as per TS.

Annexure-I

MANDATORY SPARES FOR GAS INSULATED SWITCHGEAR (GIS)

	220kV GIS Spares	Quantity
1.	Cable end termination connection & enclosure, compatible with the main Circuit	1 set (1-ph)
2.	SF6 gas Pressure Relief Devices, 03Nos. of each type	2 sets
3.	SF6 Pressure gauge cum switch OR Density monitors cum switch as applicable (3 no. of each type)	1 set complete for 1 bay + bus bar, Bus duct.+ CB
4.	Coupling device with pressure gauge for connecting Gas handling plant including GIS & Cylinder both	2 sets
5.	Rubber Gaskets, "O" Rings and Seals for SF6 gas of each type	1 set
6.	Molecular filter for SF6 gas with filter bags	20% of total quantity
7.	All types of Control Valves for SF6 gas of each type	1 set
8.	SF_6 gas	20% of total quantity
	Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment.	
9.	For 3 Phase Enclosure	2 Nos.
10.	For Single phase enclosure	3 Nos.
11.	Bus Support insulator of each type for 3 phase/single phase enclosure.	5% of installed/ used population
12.	SF6 to air bushing of each type rating including fixing arrangement	3 No.
	220 KV SF6 CIRCUIT BREAKER	
13.	Circuit Breaker pole complete of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	3 Nos.
14.	Fixed, moving and arcing contacts including insulating nozzles 3 Nos. of each type/rating of CB	1 set (3 No.)
15.	Rubber gaskets, `O' rings and seals for SF6 gas of each type	1 set
16.	Trip coil assembly with resistor as applicable, 3 Nos. of each rating of CB	2 sets
17.	Closing coil assembly with resistor as applicable, 3 Nos. of each rating of CB	2 sets
18.	Corona rings/cover if applicable	1 set
19.	Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating	1 set
20.	Closing valve assembly, 3 Nos. of each type	2 sets
21.	Trip valve assembly, 3 Nos. of each type	2 sets
22.	Auxiliary switch assembly, 3 Nos. of each type	1 set
23.	Operation Counter, 3 Nos. of each type	1 set

24.	Rupture disc, 3 Nos. of each type	1 set
25.	Spring operated closing mechanism, 1 Nos. of each type, if applicable	1 set
	For Hydraulic Operated Mechanism, if applicable	
26.	Hydraulic operating mechanism with drive motor, 3 Nos. of each type	1 Set
27.	Hydraulic filter, 3 Nos. of each type	1 Set
28.	Hose pipe, 3 Nos. of each type	1 Set
29.	N2 Accumulator, 3 Nos. of each type	1 Set
30.	Pressure transducer, 3 Nos. of each type	1 Set
31.	Valves 3 Nos. of each type	1 Set
32.	Pipe length (copper & steel) 3 Nos. of each size & type	1 Set
33.	Pressure switches 3 Nos. of each type	1 Set
34.	Pressure gauge with coupling device, 3 Nos. of each type	1 Set
35.	Hydraulic oil	20% of total qty. used
36.	Pressure Relief Device, 3 Nos. of each type	2 Set
	220KV GIS Isolator	
37.	Complete set of 3 nos. of single phase / one no. of 3-phase dis-connector including main circuit, enclosure, driving mechanism.	1 Set
38.	3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism.	1 Set
39.	Copper contact fingers for dis-connector male & female contact – for one complete (3 phase) dis-connector of each type and rating.	1 Set
40.	Copper contact fingers for earthing switch male & female contacts, for one complete (3 phase) earthing switch of each type and rating	1 Set
41.	Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	1 Set
42.	Push button switch.-each type, as applicable	1 Set
43.	Limit switch and Aux. Switches for complete 3 phase equipment	1 Set
44.	Motor with gear assembly for complete 3 phase equipment	1 Set
45.	For isolator	3 Set
46.	For earth switch	1 Set
47.	Hinge pins for complete 3 phase equipment	1 Set
48.	Relays, Power contactors, resistors, fuses, push buttons & MCBs (complete for one 3 phase equipment)	3 no
49.	Aux. switch assembly (complete) with 10 NO & 10 NC OR more contacts for both isolator & earth switch	1 Set
	220KV GIS CURRENT TRANSFORMER	
50.	Complete CT of each type and rating with packing.	2 Nos.
51.	Secondary bushing of each type	2 Set

	220 kV GIS Voltage Transformer	
52.	Complete PT of each type and rating	1 No.
	220kV GIS SURGE ARRESTOR	
53.	Complete L.A. of each type and ratings with insulating base, terminal connector, , Surge counter & accessories	1 No.
	DG Set	
54.	Set of Fuel filter (each type)	1 set
55.	Solenoid Coil Assembly	1 No.
56.	Self Starter assembly with clutch engaging and disengaging arrangements complete with motors	1 No.
57.	Lube Oil pressure safety control)	1 No.
58.	High water temp. safety control	1 No.
59.	Diode	1 No.
	BATTERY	
60.	Spare Battery Cell	5 No.
61.	Terminal connectors with nuts & bolts	10 No.
	BATTERY CHARGER	
62.	Set of control cards (All PCB cards)	1 set
63.	Set of relays	1 set
64.	Set of contractor	1 set
65.	Micro-switches (if applicable)	1 set
66.	Filter Capacitor	1 set
67.	Three phase full wave bridge rectifier (Thyristor/Diode)	1 set
68.	Set of wound resistor (if applicable)	1 set
69.	Set of switches	1 set
70.	Potentiometer	1 set
71.	Fuses of Thyrister with indicator	1 set
	Relay & Protection Spare (for each voltage class)	
	Breaker Relay Panel	
72.	Breaker failure Relay	1 No
73.	Trip Circuit Supervision Relay	2 No
74.	Self Reset Trip Relay of each type (if applicale)	1 No
75.	Timer Relay of Each type (if applicale)	1 No
76.	DC Supervision Relays (if applicale)	1 No
	Line Protection Panel Equipments Spares	
77.	Main 1 Numerical Distance Relay (Excluding External Trip Relays)	1 Set
78.	Main 2 Numerical Distance Relay (Excluding External Trip Relays)	1 Set
	Transformer Protection Panel	
79.	Transformer Differential Protection Relay Including all AUX. CTs (if applicale)	1 No
80.	Restricted Earth Fault Protection Relay with Non Linear Resitor (if applicale)	1 No

81.	Backup Protection Relay with Three O/C and E/F Element	1 No
82.	Over Fluxing Relay (if Stand alone)	1 No
83.	CVT selection relay (if stand alone)	1 No
84.	Over Load Relay with Timer (if Stand Alone)	1 No
	Sub-station Automation System Spare	
85.	Bay Control Unit (of each type)	1 No
86.	Ethernet Switch of Each type	1 No
87.	optical cable with end terminations of each length/type	5 set
88.	**Fire Fighting System**	1 LS
89.	**Illumination System**	1 LS
90.	**LT Switchgear**	1 LS

Annexure-II

List of Drawings for 220/33kV Gas Insulated sub-station Subzi Mandi (Annexure-IIA).

1. Tentative Single Line Diagram of 220/33kV GIS Sub-station
2. Single Line Diagram of Existing Sub-station
3. Tentative Layout Plan of 220/33kV GIS Sub-station - Land Area and Location
4. Tentative SAS Architecture (In section-13: Substation Automation,)

Annexure-III

TECHNICAL PARAMETERS FOR TERTIARY LOADING EQUIPMENTS FOR 100MVA TRANSFORMER

A. **36kV, outdoor type, SF6 Circuit Breaker Technical Parameters**

a) Rated Current (A) – 630
b) Insulation level - BIL- 170kVpeak
c) Short time rating – 31.5KA for 1 sec.
d) The circuit breaker shall be provided with the provision of local and remote operation.

B) 33kV, outdoor type, Current Transformer Technical Parameters

a) Ratio: 400-200-100/1-1-1A
Core-I Metering
Core-II PS class
Core-III PS class
b) Insulation level - BIL- 170kVpeak
c) Short time rating – 31.5KA for 1 sec.
d) Class - 0.2S – metering
e) VA burden - 20 each

C) 11kV, outdoor type, Potential Transformer Technical Parameters

a) Ratio - 11kV/√3 / 110V/√3/110V/√3.
b) Insulation level - BIL- 170kVpeak
c) Class - 0.2 – metering
3P - open delta protection
d) VA burden - 20 each

D) 33kV, outdoor type, isolator with earth switch Technical Parameters

a) Isolator shall be horizontally mounted MOM type with local and remote operation.
b) Insulation level - BIL- 170kVpeak
c) Short time rating – 31.5KA for 1 sec.

E) 11 kV Surge Arrester

The rating of surge arrester shall be finalized during detailed engineering.

F) Control & Relay protection scheme

The control & relay panel for tertiary shall be mounted either in 33kV incomer panel or in separate panel. Tertiary control shall also be monitored through sub-station automation system, however, various items are required for control & relay panel is as follows:-

i) One Multifunction Meter.
ii) One Static Tri- vector meter 0.2 Class, ABT compliant.
iii) One Control switch for circuit breaker operation.
iv) LED for C.B/ Isolator closed/ open position in red and green colour.
v) Alarm and LED for DC failure.
vi) One painted mimic bus equipped with symbols and semaphore indicators to represent breaker position.
vii) LED for auto trip in amber colour.
viii) LED blue coloured for C.B. spring charged condition (if required).
ix) DC supervision scheme.
x) Push button and bulb for on demand checking of trip circuit healthy for ON/OFF position with relay.
xi) Static O/C and E/F relay.
xii) Inverse characteristic Neutral unbalance voltage relay.
xiii) Bell operation on DC.
xiv) Buzzer operating on 230V A.C.
xv) Push button for alarm cancellation.
xvi) Test terminal block for testing of meters.
xvii) Set of auxiliary relays and tripping relays required to complete the scheme.
xviii) A.C failure relay.

G) The sub-station auxiliary supply is normally met through a system having the following parameters. The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation system shall also conform the parameters as indicated in the following.

Normal Voltage	Variation in Voltage	Frequency in Hz	Phase/Wire	Neutral connection
415V	+/- 10%	50 +/- 5%	3/ 4 Wire	Solidly Earthed.
240V	+/- 10%	50 +/- 5%	1/2 Wire	Solidly Earthed.
220V	190V to 240V	DC	2 wire	Isolated System

Combined variation of voltage and frequency shall be limited to +/- 10%.

Annexure-IV

LIGHTING SPECIFICATION

A. GENERAL

1. GIS BUILDING

The GIS Building main halls will be illuminated using enclosed type high bay, luminaries having 250 watt metal halide fixtures along with surface mounted 1x60W GLS down lighters for emergency areas. Use of LED based low power consumption luminaries to achieve desired lux level specified can also be used as finalized during detailed engineering.

2. CONTROL ROOM LIGHTING

i. Control room area will be illuminated using mirror optics luminaries, which have superb glare control, the luminaries will have Cat II mirrors. Philips TBS 088 / 236 C5 HF or equivalent.

ii. In addition to mirror optics luminaries CFL down lighter with turbo louvers will be used. The luminaries would be suitable for 2XPL 16 Watt Lamp.

iii. For non false ceiling areas, the illumination will be carried out using 2x28 Watt lamps with industrial reflector Philips TMS 122 / 228 HF or equivalent.

iv. DC Emergency Lighting in non false ceiling areas to be carried out with surface mounted down lighters.

v. For all areas necessary exit sign lights and minimum 4 nos portable emergency lights will be provided.

vi. Use of LED based low power consumption luminaries to achieve desired lux level specified can also be used as finalized during detailed engineering.

3. Following Average Lux Levels will be maintained :

S. No.	Description	Lux	Uniformity
i.	Control Room	350 Lux	0.8
ii.	GIS Building	200 Lux	0.7
iii.	Offices	300 Lux	0.8
iv.	Indoor areas other	150 Lux	0.7

4. Control :

Sufficient number of occupancy and light level sensors shall be provided subject to following minimum requirement:

Sl. No.	Area	No. of Occupancy Sensor	No. of Light Level Sensor
1	Control Room	1	1
2	Conference Room	1	1
3	Room For Engineers	4	---
4	Room for Non-executive	1	---
5	S/Stn. In-charge Room	1	---
6	Electronic Lab	1	1
8	220kV GIS Hall	---	4
9	33kV GIS Hall	---	4

No occupancy sensor and light level sensors are envisaged for ACDB room, DCDB room, Lobby, Corridor and DG set. Each light level sensor shall be provided to measure and regulate lighting. The light level sensor shall be used to achieve bank switching. Each occupancy sensor shall be used for indoor use with time delay programmable in the minimum range of 1 sec. to 2 Hour to control the illumination in the area.

B. Technical specifications for LED Luminaries for Control Room, GIS Building ETC. Illumination

1. SCOPE

This specification covers the general requirements of design, engineering, and manufacture, assembly, testing at manufacturer's works, packing and delivery at site of the energy efficient LED

outdoor lamps along with associated LED drivers, fixtures and other accessories for switchyard lighting in Substations.

2. APPLICABLE STANDARDS & CODES

LED Street Light shall be designed, manufactured and tested in accordance with the latest applicable Indian Standard and IEC standard as listed below –

Standard Code	Standard Description
IS 16101 : 2012	General Lighting -LEDs and LED modules – Terms and Definitions
IS16102(Part 1) 2012	Self-Ballasted LED Lamps for General Lighting Services, Part 1 Safety Requirements
IS16102(Part 2) 2012	Self-Ballasted LED Lamps for General Lighting Services, Part 2 Performance Requirements
IS16103(Part 1) 2012	Led Modules for General Lighting, Part 1Safety Requirements
IS16103(Part 2) 2012	Led Modules for General Lighting, Part 2 Performance Requirements
IS15885(Part2/Sec13)	Safety of Lamp Control Gear , Part 2 Particular Requirements , Section 13 dc. or ac. Supplied Electronic Control gear for LED Modules
IS16104 : 2012	d.c. or a.c. Supplied Electronic Control Gear for LED Modules -Performance Requirements
IS16105 : 2012	Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources
IS16106 : 2012	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products
IS 16107(Part 1)2012	Luminaries Performance ,Part 1 General Requirements
IS 16107(Part 2)2012	Luminaries Performance, Part 2 Particular Requirements, Section 1 LED Luminaries
IS 16108 : 2012	Photo biological Safety of Lamps and Lamp Systems
IS 10322 : 2012	Luminaries: Part 5 Particular requirements, Section 3 Luminaries for road and street lighting
IEC 62612	Self-ballasted LED lamps for general lighting services for voltage above 50 V — Performance requirements
IEC : 60598-2-3	Particular requirements - Luminaries for road and street Lighting
IEC 62471	Photo biological safety of lamps and lamp systems
IEC 62778	Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaries
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
IEC/PAS 62717	Performance requirements – LED modules for general lighting
IEC/PAS 62722	Performance requirements – LED luminaires for general lighting

Material conforming to other internationally accepted standards, which ensure equal or better quality than the standards mentioned above would also be acceptable. In case the bidder who wishes to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English translations shall be furnished along with the offer.

3. CLIMATIC CONDITIONS:

The equipment covered under this specification is for outdoor installation and the climatic conditions that are prevailing at the sites in Delhi.

1.	Reference ambient temperature:	43.3 º C as per IS 9676
2.	Maximum ambient air temperature	50ºC
3.	Maximum daily average ambient temp	40ºC
4.	Maximum Relative Humidity	100%
5.	Minimum Relative Humidity	10%
6.	Average annual rainfall	750 mm
7.	Average no. of rainy day	50
8.	Average no. of thunderstorm days per annum	40

9.	Altitude	Not exceeding 300 meters
10.	Rain months	June to Oct.
11.	Wind pressure as per IS 875	195 Kg/Sq. meters up to 30 meters

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. Heavy lightening occurs in the area during rainy months (June to October).

All equipment shall be designed to withstand seismic forces, corresponding to an acceleration of 0.3 g horizontal.

4. Technical Design & construction Parameters:

S.No.	Technical Particulars	Required technical parameters	
A	**Fitting (Luninairs)**	**LED Switch Yard Lighting**	
1.	Distribution	Type-II	
	Usage hours	Dusk to dawn (12 hours)	
2.	Lens Type	Polycarbonate	
	Beam angle	120 Degree-min	
3.	Working Humidity	**10-100% RH 1**	
	Working temperature	**-10 to 50 ℃**	
4.	Wattage (System wattage)	100W ± 5%	150W ± 5%
5.	Luminary efficacy as per LM-79	>100 Lumen/watt	>100 Lumen/watt
6.	Minimum Lumens of Fitting	Minimum 12000Lumens	Minimum 15000 Lumens
7.	Pole entry dia	50-60 mm	50-60mm
8.	Luminaries protection	Class 1	
9.	Maximum variation allowed in luminary light output (lumen) throughout in the input operating voltage range	The voltage variations/fluctuations in the specified voltage range shall not impinge upon the lumen it produces. Maximum variation +/-2% is allowed in luminary light output (lumen) throughout in the input operating voltage range.	
10.	Input Voltage	240 Volts +/- 10%	
11.	Input Frequency	50Hz +/-3%	
12.	Operating voltage range	120-270V	
13.	Power Factor	≥0.95	
14.	Overall total harmonic distortion	<10% as per EN 55015 or EN 61000-3-2	
15.	Surge protection	≥10kv inbuilt or "5KV internal (inbuilt) and 5KV external" with NABL Lab test report	
16.	Index of protection level for optical & control gear	IP 66	
17.	Impact resistance	≥IK07	
18.	Housing	Single piece Corrosion free High Pressure aluminum die cast with manufacturer's embossed/engraved. The luminaries shall be built in such a way that it can withstand wind speed of150kmph. NABL accredited lab report supporting the same shall be furnished by the manufacturer.	
19.	Driver Housing	Integral	
20.	The luminaries should meet the standard	IEC 60598-1	
21.	Cover/Glass	UV stabilized poly carbonate/Toughened glass	
22.	Screw/faster & clamps	Stainless Steel	
23.	Type Tests report as per IS : 10322 Part 5 sec-3/IEC : 60598-2-3	From NABL accredited TPL (IP classification is IP 66, INSITU/Junction temp measurement shall be part of Thermal test)	
24.	Test report as per LM79/IS:16106	From ILAC/MRA/NVLAP/KOLAS/EPA/NABL accredited TPL (IP classification is IP 66)	

25.	Test report for IK07	As per IS 10322
26.	Test report with summary for compliance as per tender parameters (Operating voltage, Constant light output, Luminous flux per watt, CCT, CRI, Uniformity calculation, P.F, Wattage.	For LED parameters like lumen per watt, CCT, CRI, Beam Angle from LED Manufacturer or TPL.
27.	LM80/IS:16105 report	From ILAC/MRA/NVLAP/LOLAS/EPA/NABL accredited Manufacturer or TPL.
28.	Conformation standards of luminaire (Test reports of luminaire)	The luminaire should conform to IEC 60598/IS:10322 The luminarie should be tested as per IEC 60598-2-3:2002/IS:10322 Part 5 Sec-3 standards and following test reports should be submitted from NABL certified TPL TEST REPORT as per IS:10322 part 5 Sec-3/IEC:60598-2-3: Heat Resistance Test, Thermal Test, Ingress Protection Test, Drop Test. Electrical/Insulation Resistance Test, Endurance Test, Humidity Test, Photometry Test (LM79 report), Vibration Test.
B)	**LED**	
1)	Single LED chip for a single category/wattage of product.	Single LED chip is allowed for a single category/wattage of product, mixing of chip is not allowed for single product.
2)	LED Test Report	For LED parameters like Lumen per watt, CCT, CRI, Beam Angle from ILAC/MRA/NVLAP/KOLAS/EPA/NABL accredited Manufacturer or TPL
		LM 80/IS:16105 report from ILAC/MRA/NVLAP/KOLAS/EPA/NABL accredited Manufacturer or TPL
		IEC 62471 and assessment of blue light as per IEC/TR 62778-Ed.1.0
3)	Type of LED	Discrete high power LED with individual lens >1W and <3W
4)	Color Rendering Index (CRI)	>70
5)	CCT	≥ 5700K as per ANSI Bin
6)	Junction temperature	Tj≤85˚ provided Luminary housing temperature rise should not be more than 25 C over ambient temperature after 48 hours continuous operation.
7)	LED Efficacy	>135lm/W
8)	Life expectancy	≥ 60,000 hours at 70% lumen maintenance (LM70)
9)	LED should meet the standard	IEC 62471 2006-07 (photo biological safety of lamps and lamp systems)LM-80 and Assessment of blue light as per IEC/TR 62778.
10)	Light distribution	LED with secondary lens
C	**LED Driver**	
1)	Efficiency	≥85%
2)	Make of Driver	Similar to manufacturer make
3)	LED Driver Test Report	Type Tests report as per IS:15885-Part 5 Sec-13, IS: 16104
		Test Report as per tender specification (Driver Efficiency, >85% THD, < 10% Surge Protection > 10KV)
4)	Life of Driver	≥ 50000 hours
5)	Surge Voltage Protection	≥ 10kv inbuilt or “5KV internal (inbuilt) and 6KV

		external"
6)	Driver Current (Ampere)	≥ 350MA ≤1000mA
7)	Protection	Over voltage, short circuit, open circuit and Reverse polarity, Environmental. Potted with flame retardant thermal potting compound. CE Making, ENCE, RoHS Compliance, UT
8)	Construction	
9)	Driver Certification	
10)	Driver Approval	BIS approved driver with R Number certificate to submitted.
D	**Body & Other Parameters**	
1)	Type of housing (Material & Const.)	Single piece Corrosion free aluminum High Pressure die cast with manufacturer's Embo'ssed/engraved.
2)	Type of Cover/Glass	Toughened glass/UV stabilized Polycarbonate cover
3)	Type of heat Sink	Pressure die cast
4)	IP Protection Class	IP -66
5)	Finish	Polyester Power coated
6)	Screw/fastener & clamps	Stainless steel
7)	Product qualities	The luminaries shall be supplied with lable, giving indication of serial number, model and system lumen pack, nominal CCT, wattage of fitting, Date of Manufacturer, and other labeling details as per IS.
E	**Documents to be submitted**	
1)	5 year Guarantee Certificate	From Manufacturer/OEM.
2)	Test reports (LM 79, LM 80, Type Test Report, Technical Data Sheet, IP	From NABL accredited Third party lab covering NIT specifications.
3)	Copy of Technical Catalogues	
4)	Details of Service Centres	
5)	Photometric Report of fitting	LM 79 report from NABL Lab.
6)	Ref. of IS/IEC (if any) for type test	IS-10322 (Part 5/Sec 3)

5. NAME PLATE & MARKING:

Followings shall be clearly engraved/embossed on the die cast housing of LED Luminaries Housing:

a. Rated voltage or voltage range (marked 'V' or 'Volt');
b. Rated current (marked A' or 'Ampere');
c. Rated wattage (marked 'W' or 'Watts');
d. Rated frequency (marked in 'Hz')
e. Power factor
f. Rated lumen
g. Indian/International Standards to which it is
h. Manufactured
i. Month and year manufacture
j. Customer name as DTL
k. Fitting serial number
l. DTL PO no and date
m. Guarantee period

Following information shall be printed on the Control gear Driver Name plate:-

a. Operation Voltage range
b. Output voltage
c. Guaranteed period
d. DTL PO no. & date
e. Customer name as Delhi Transco Ltd.

6. TESTS:

The LED light must be of type tested from CPRI/ERDA/NABL/Equivalent accredited laboratory in accordance with IS 16102, IS 16103 and IS 16107 (PART-1,PART-2 2012) and reports shall be furnished along with the tender.

All Routine Tests, Acceptance tests shall be carried out in accordance with the relevant IS/IEC with latest in the presence of purchaser representative if so desired by the purchaser.

7. DRAWINGS, DATA & MANUALS TO BE SUBMITTED (FOR INFORMATION ONLY)

7.1	To be submitted along with bid	The bidder has to submit the following documents: a. Catalogues of the selected LED and Luminaire fittings. b. Guaranteed Technical Particulars c. General arrangement drawing of the LED light d. Calculation documents to substantiate choice of the LED and the Luminaire fittings. e. Verifiable Type Test Certificate of the LED and its luminaire carried out on identical Design and type of the unit of the same rating f. An illustrated literature on the LED giving technical information on the operational details and the current ratings, short circuit ratings, derating factors for different types of installation, packing date, weights and other relevant information.
7.2	After award of contract, seller has to submit mentioned drawings for buyer's Approval (A) /Reference (R)	The bidder has to be submit the following documents: a. Guaranteed Technical Particulars b. Calculations to substantiate choice of electrical, mechanical component size / ratings c. General arrangement drawing of the LED street light d. Programme for production & testing e. Detailed installation and commissioning instructions f. Quality Assurance plan
7.3	Submittals required prior to dispatch	a. Inspection and test reports, carried out in manufacturer's work b. Test certificates of all bought out items c. Operation and maintenance instruction as well as trouble shooting charts / manuals.

8. WARRANTY/GUARANTEE PERIOD

The full luminary shall be guaranteed against manufacturing defects, material, workmanship and design for the period of **05 years** from date of receipt of material. The guarantees for replacement of materials/accessories shall be provided free of charge at purchasers premises..The guarantee will be without prejudice to certificate of inspection or material receipt note issued by DTL.

Guarantee Technical particular of LED Luminaries:

S.No.	Technical Particulars	To be submitted by Bidder
A	**Fitting (Luminaries)**	
1)	Make	
2)	Manufacturing address	
3)	Model No.	
4)	Distribution	
5)	Usage hours	
6)	Lens Type	
7)	Beam angle	
8)	Working Humidity	
9)	Working temperature	
10)	Wattage (System wattage)	

11)	Luminary efficacy as per LM-79	
12)	Minimum Lumens of Fitting	
13)	Pole entry dia	
14)	Luminaries protection	
15)	Maximum variation allowed in luminary light output (lumen) throughout in the input operating voltage range	
16)	Input Voltage	
17)	Input Frequency	
18)	Operating voltage range	
19)	Power Factor	
20)	Overall total harmonic distortion	
21)	Surge protection	
22)	Index of protection level for optical & control gear	
23)	Impact resistance	
24)	Driver Housing	
25)	The luminaries standard	
26)	Type Tests report as per IS : 10322 Part 5 sec-3/IEC : 60598-2-3	
27	Test report as per LM79/IS:16106	
28	Test report for IK07	
29)	Test report with summary for compliance as per tender parameters (Operating voltage, Constant light output, Luminous flux per watt, CCT, CRI, Uniformity calculation, P.F, Wattage.)	
30	LM80/IS:16105 report	
31	Conformation standards of luminaire (Test reports of luminaire)	
B	**LED**	
1)	Make of LED	
2	Type of LED	
3	Model No. of LED	
4	Wattage of LED	
5	Number of LED used	
6	Color Rendering Index (CRI)	
7	CCT	
8	Junction temperature	
9	LED Efficacy	
10	Life expectancy	
11	LED Ref standard	
12	Light distribution	
13	Driving Current	
C	**LED Driver**	
1)	Efficiency	
2)	Make of Driver	
3)	LED Driver Test Report	
4)	Life of Driver	
5)	Model No. of Driver	
6)	Surge Voltage Protection	
7)	Driver Current (Ampere)	
8)	Protection	
9)	Construction	
10)	Driver Certification	
11)	Driver Approval	
D	**Body & Other Parameters**	
1)	Type of housing (Material & Const.)	
2)	Type of Cover/Glass	
3)	Type of heat Sink	
4)	IP Protection Class	
5)	Weight of fitting	

ANNEXURE-V

TECHNICAL SPECIFICATION FOR 33kV XLPE CABLE

1.0 **SCOPE**

1.1 Scope of this section covers the general technical data of the system and also the technical requirement of the 33 kV Cable.

1.2 **SYSTEM PARAMETERS:**

The brief particulars of the 33 kV system parameters are given here after:-

(i)	Nominal system voltage	33 KV rms.
(ii)	Highest system voltage	36 KV rms.
(iii)	Impulse withstand voltage 1.2/50 micro Seconds wave of positive/negative polarity .	170 KV peak
(iv)	System Frequency	50 Hz.
(v)	No. of phase per circuit	Three
(vi)	System Earthing	solidly grounded.
(vii)	Ratted short time current	31.5 KA
(viii)	One minute Power Frequencywithstand voltage	70kVrrms
(ix)	Duration of fault current	one second

1.3 **CABLE**

1.3.1 The cross linked polyethylene insulated (XLPE) cable (Dry cured) shall be manufactured in accordance with the internationally accepted standard and also confirm to the requirements of IEC Publication No.502 " Extruded solid dielectric insulated power cable for rated voltage from 1 KV to 30 KV".

1.3.2 The cable shall be suitable for laying in an area likely to be flooded by water and shall be designed to be protected against rodent and termite attack.

1.3.3 The construction of cable shall generally confirm to the description in this specification. Tender shall enclose with Bid offer required drawing showing cross-section of the cable.

1.3.4 The supplier shall quote for 33 KV XLPE insulated single core cable, of solid extruded dielectric with metallic sheath with an outer PVC jacket. The supplier shall furnish technical justification for choice of the metal sheath.

1.3.5 The conductors screen, (non-metallic semi conductive) insulation and insulation screen (non-metallic semi conductive) shall all be extruded in a single one time process to ensure homogeneity and absence of voids.

1.4 **CONDUCTOR**

The tendered shall quote for XLPE cable with aliminium conductor of 1000 Sq mm cross section. The shape of the conductor shall be compact circular standard.

1.5 **CONDUCTOR SHIELD:**

The conductor shield shall consist of extruded semi conductive XLPE. Semi-conducting separator tapes shall be supplied between conductor and the extruded semi conductor XLPE.

1.6 **INSULATION:**

The extruded XLPE insulation shall be of very high degree of purity and dry cured. The average thickness shall not be less than the nominal value given in IEC-811. The minimum thickness at any point shall not fall below the nominal value by more than 10%.

1.7 **INSULATIONS SHIELD**

The insulation shield shall consist of extruded semi conducting XLPE. Suitable bedding tapes shall be supplied over the extruded semi conducting XLPE.

1.8 **ARMOUR**:

There shall be Armouring of Round/Flat type

1.9 **OUTER JACKT:**

The outer jacket shall consist of extruded black colored PVC. The minimum thickness at and point shall not fall below 90% of the nominal.

1.10 **RATING:**

1.10.1 The cable size shall be suitable to carry the load current on 3 kV continuously followed by a 10% overloading capacity for two hours without exceeding the maximum conductor temperature of 90^0C (The manufacturer shall specify such final temperature which shall unsure that there is no loss of life of the cable insulation.) The cable rating size shall be based on loading of 2 Nos. three phase circuit at an ambient temperature of 50^0C and soil temperature of 35^0C. A complete set of experimentally verified data and calculation made in arriving at the conductor rating shall be enclosed with the offer.

2.0 **TYPE TESTS:**

2.1 The cable shall confirm to all Type, Routine and Acceptance tests listed in the relevant IS/IEC.

1.2 The cable should have been type tested for all type tests as per IS: 10810 “Methods of test for cables” including its amendments for XLPE insulated LT Cable and its report shall be submitted to Employer for its acceptance.

1.3 The bidder shall submit type test reports for all type test as per IS: 10810 including amendments for employer’s acceptance for accessories for 33kV XLPE cable.

3.0 **CABLE LAYING & TERMINATION:**

33kV XLPE cable shall be laid from ICT to GIS in buried cable trench. Single point bonding system shall be employed along with sheath voltage limiters (SVL), if required, to limit the standing voltage to 65V. Laying route along with cable length shall be planned to keep provision of a future cable joints in all cables by providing S bend

ANNEXURE-VI

TECHNICAL SPECIFICATION OF 33kV CURRENT TRANSFORMER OF RATIO 400-200-100/1-1-1 A for TERTIARY LOADING of 100 MVA POWER TRANSFORMER

1.0 **GENERAL**

1.1. The 33 KV Current Transformer shall be out door, of Ratio 400-200-100/1-1-1A complete with terminal connectors.

1.2. The Technical features and construction details of each current transformer shall be in accordance with the requirement stated herein under.

1.3. The equipment quoted under this specification shall conform to the standards specified below unless otherwise specified, the equipment shall conform to the latest applicable IS/IEC.

2.0 STANDARDS

2.1. The design, manufacture and performance of the equipment provided under this specification shall comply with the standards given in the clause 2.2.

2.2

Indian Standard No.	Title
a) IS-2705 (part I to V)	: Specification for current Transformer
b) IS-4201	: Application guide for current Transformer.
c) IS-2099/ IS-5621	: High voltage porcelain Bushings/Hollow Column insulators.
d) IS-731	: Insulator for O/H Power line
e) IS-335	: New insulating oil for transformer and switchgear.
f) IS-9676	: Reference ambient temperature

3.0 SYSTEM PARAMETER

The 33 KV system parameters are as follows:

a) Nominal system voltage:	33 KV
b) Highest system voltage:	36 KV
c) Frequency:	50 Hz.
d) Earthing of the system:	solidly grounded
e) Insulation level:	
i) Impulse voltage withstand	170 KV (P)
ii) Power frequency withstand	70 KV (rms)
f) Short time current rating and its duration	31.5 KA for 1.0 Second

4.0 TECHNICAL PARTICULARS OF CURRENT TRANSFORMERS

4.1. 33 KV C.T. of ratio 400-200-100/1-1-1 A

CORE – I : METERING

a) Secondary Current	1 Amp.
b) Purpose	Metering
c) Rated output	20 VA
d) Class of Accuracy	0.2S
e) Instrument security factor	≤ 5

CORE – II: BACK UP PROTECTION (O/C & E/F)

a) Secondary Current	1 Amp.
b) Purpose	O/C & E/F Protection
c) Min. Knee point voltage VK	$40(R_{ct}+8)$ V (Rct.-Resistance of secondary winding)
d) Class of Accuracy	PS
e) Max. exciting current at VK/2	30 mA

CORE – III: TRANSFORMER DIFFERENTIAL PROTECTION

a) Secondary Current	1 Amp.
b) Purpose	Transformer differential
c) Class of Accuracy	PS
d) Min. Knee point voltage VK	$40(R_{ct}+8)$ V (Rct.-Resistance of secondary winding)
e) Max. exciting current at VK/2	30 mA

6.0 CONSTRUCTION DETAILS

6.1. The current transformers shall be oil immersed and self cooled outdoor type suitable for the specified services indicated, completed in all respects and in accordance with best engineering practice design and workmanship.

6.2. The core shall be of high grade non ageing, electrical silicon laminated steel of low hysteresis loss high permeability to ensure high accuracy at normal and over current conditions and shall produce undistorted secondary current under transient conditions at all ratios.

6.3. The oil immersed CT shall be hermetically sealed to eliminate breathing and to prevent air and moisture and shall be provided with a pressure relieving device capable to releasing abnormal internal pressure. C.T. shall be provided with oil level gauge, and necessary arrangement for replacing the oil shall be provided.

6.4. The current transformers shall be suitable for simultaneous 100% full load continuous rating of the winding.

6.5. The ratio changing taps shall be provided only on the secondary winding of the C.T.

6.6. The current transformer cores to be used for metering and instrumentation shall be of accuracy class specified and suitable for commercial and industrial metering. The Saturation factor of this core shall be low enough not to cause any damage to measuring instruments in the event of maximum short circuit current.

6.7. Current transformers cores to be used for protective relaying purposes shall be of accuracy class specified, suitable for distance protection, pilot wire protection, differential protection, restricted earth fault protection, over current and earth fault protection. Over current and earth fault for a maximum saturation factor as specified for the highest setting.

6.8. The secondary terminals shall be brought out in a weather proof terminal box (with degree of protection IP55) on the side of the current transformer and shall be accessible through a removable cover. The secondary tap shall be adequately reinforced to withstand normal handling without damage. Suitable cable glands shall be provided to accommodate purchaser's control cables.

6.9. The maximum permissible temperature rise of the windings over the ambient shall not exceed 50^0C.

6.10. The magnetising curve for each core shall be furnished with the tender.

6.11. The secondary terminals shall be provided with short circuiting and earthing arrangements at the terminal block.

6.12. The C.T.s shall be suitable for horizontal as well as vertical transportation.

6.13. The Instrument security factor at all ratios shall be less than 5 for metering cores.

6.14. The C.T. shall be suitable for high speed auto-reclosing.

7.0 INSULATION OIL:

The quality of insulating oil in each transformer shall be best available and the complete specification of the oil shall be furnished in the tender. The current transformers offered shall be hermetically sealed completely filled with insulating oil. The insulating oil shall conform to the latest Indian Standard specification No. 335.

8.0. BUSHINGS / INSULATORS:

i) a) Porcelain used in bushing/Insulator manufacture shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might effect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

b) Glazing of the porcelain shall be of uniform brown colour free from blisters, burrs and similar other defects. Bushings shall be designed to have ample insulation, mechanical strength and rigidity for the conditions, under which they will be used.

ii) When operating at normal rated voltage there will be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings/ Insulator when operating at the normal rated voltage.

iii) All iron parts shall be hot dip galvanized and all joints shall air tight. Surfaces of the joints shall be trued up, porcelain parts by grinding and metal parts by machining. Bushing/ Insulator design shall be such as to ensure a uniform compressive pressure on the joints.

iv) The creepage distance of the bushing /Insulator shall in no case be less than 25mm/KV, suitable for heavily polluted atmosphere.

v) Bushing/ Insulator shall be tested for type tests and routine tests in accordance with stipulation of IS-2099/ IS-5621 Routine as well as type tests reports in conformity with IS-2099/ IS-5621 shall be furnished to the purchaser.

vi) Parameters of Bushings/Insulators:

a)	Rated Voltage	: 36 KV
b)	Impulse withstand voltage	: 170 KVp
c)	Power frequency withstand voltage (dry & wet)	: 70 KV (rms)
d)	Total creepage distance	: 900 mm
e)	Pollution level	: Suitable for Heavily Polluted Atmosphere

9.0 TERMINAL CONNECTORS

9.1. The current transformer offered shall be supplied with indigenous rigid type, Die casted, bimetallic (wherever applicable) terminal connectors suitable for single/double/quad ACSR Zebra conductor as per requirement conforming to IS-5561 for maximum current rating of CT.

9.2. The Neutral current transformer offered shall be supplied with one no. rigid type bimetallic (wherever applicable) terminal connector suitable for connecting to twin 75x12 mm flat of station earth. Also one no. terminal connector for connection to transformer neutral and suitable for ACSR Zebra shall be supplied.

9.3. Suitable terminal connectors for earthing connections shall also be supplied.

10.0 TESTS

10.1 The copies of certificates of all type tests as stipulated in IS: 2705 shall be furnished along with the tender.

10.2 Each current transformer shall be subjected to routine tests as specified in IS: 2705 in the presence of Purchaser's representative if so desired by the Purchaser. All test reports should be submitted and should be approved by the purchaser before dispatch of the equipment

11.0 MARKING

11.1. Rating plate : As per IS-2705 (Part-I)

11.2. Terminal marking: As per IS- 2705 (Part. I)

ANNEXURE-VII

Fire Detection and alarm System

This system shall be provided for control room building and Switchyard panel rooms of substations.

1. Suitable fire detection system using smoke detectors and/or heatdetectors shall be provided for the entire building, including corridor andtoilets. Fire detectors shall be located at strategic locations in variousrooms of the building. Each Switchyard panel room shall be considered a separate zone. Adequate number of extra zones shall be provided forSwitchyard panel rooms for future bays identified in Single line diagram of the substation. The operation of any of the fire detectors/ manual call point should result in the following;
   a. A visual signal exhibited in the annunciation panels indicating the area where the fire is detected.
   b. An audible alarm sounded in the panel, and
   c. An external audible alarm sounded in the building, location of which shall be decided during detailed engineering.
   d. If the zone comprises of more than one room, a visual signal shall be exhibited on the outer wall of each room.
2. Each zone shall be provided with two zone cards in the panel so that system will remain healthy even if one of the cards becomes defective.
3. Coverage area of each smoke detector shall not be more than 80 m2 and that of heat detectors shall not be more than 40 m2. Ionisation type smoke detectors shall be provided in all areas except pantry room where heat detectors shall be provided. If a detector is concealed, a remote visual indication of its operation shall be provided. Manual call points (Break glass Alarm Stations) shall be provided at strategic locations in the control room building. All cabling shall be done through concealed conduits.
4. Cables used should be exclusively for fire detection and alarm system and shall be 2Cx1.5sq.mm Cu. cables. Un-armoured PVC insulated FR cables conforming to IS 1554 (Part 1) shall be used.

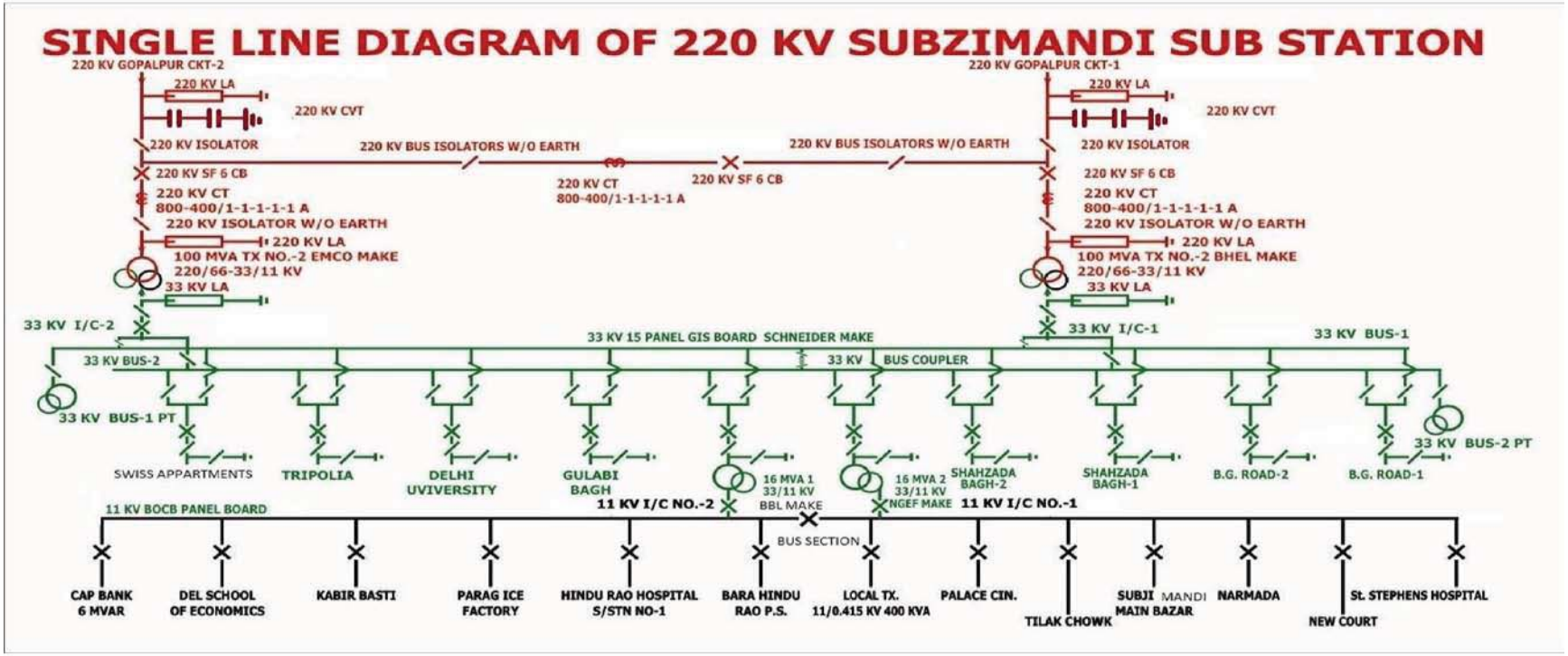
Annexure – II A

The co-ordinates of DTL Subzi Mandi substation premises with Google earth location along-with existing Single Sine Diagram (SLD) are as under:-

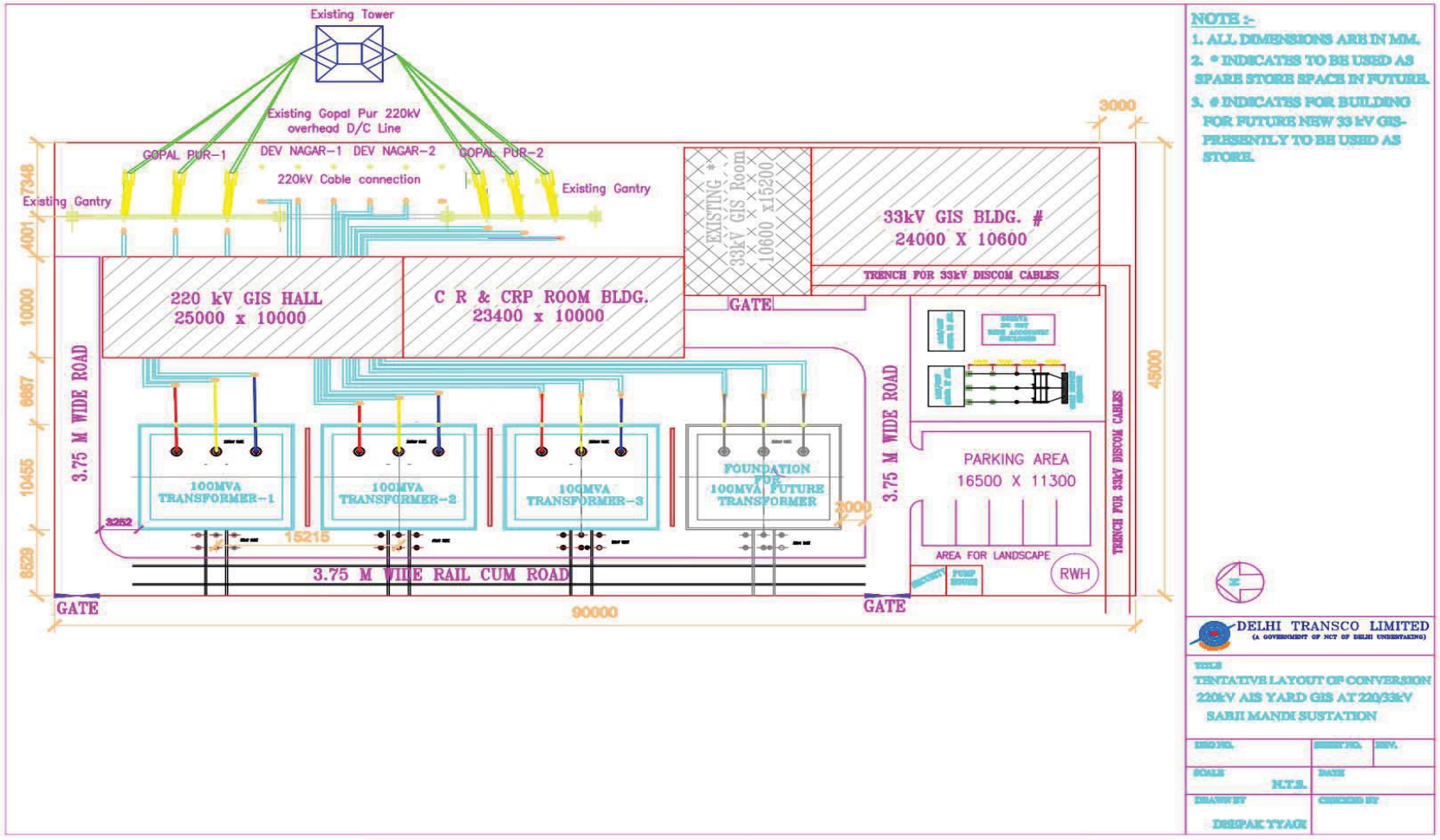
Latitude - 28°40'15"N Longitude- 77°12'31"E



SINGLE LINE DIAGRAM (SLD) OF EXISTING SUBSTATION



TENTATIVE LAYOUT-SUBSTATION



NOTE :-

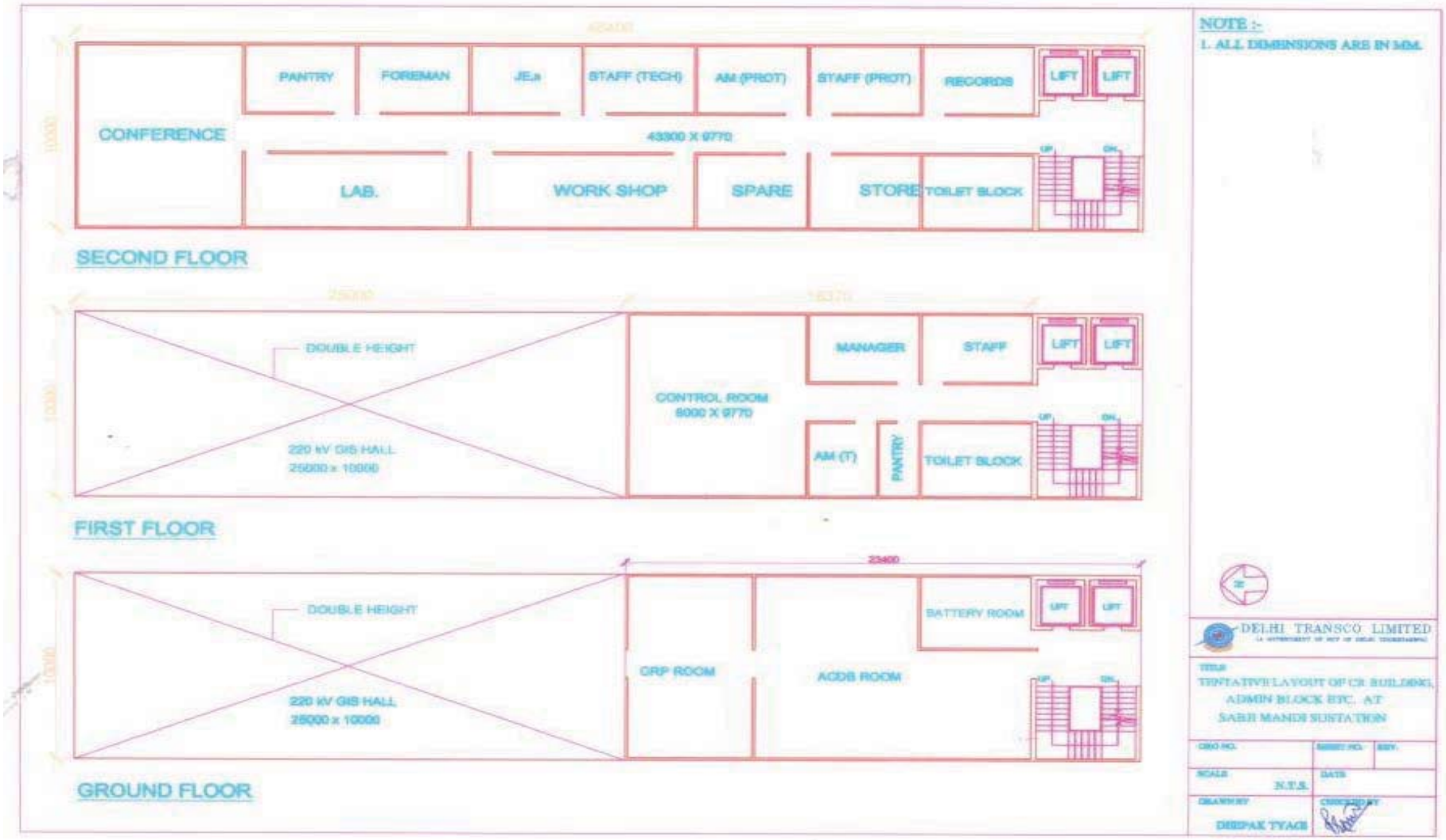
1. ALL DIMENSIONS ARE IN MM.
2. * INDICATES TO BE USED AS SPARE STORE SPACE IN FUTURE.
3. # INDICATES FOR BUILDING FOR FUTURE NEW 33 kV GIS- PRESENTLY TO BE USED AS STORE.

DELHI TRANSCO LIMITED
(A GOVERNMENT OF NCT OF DELHI UNDERTAKING)

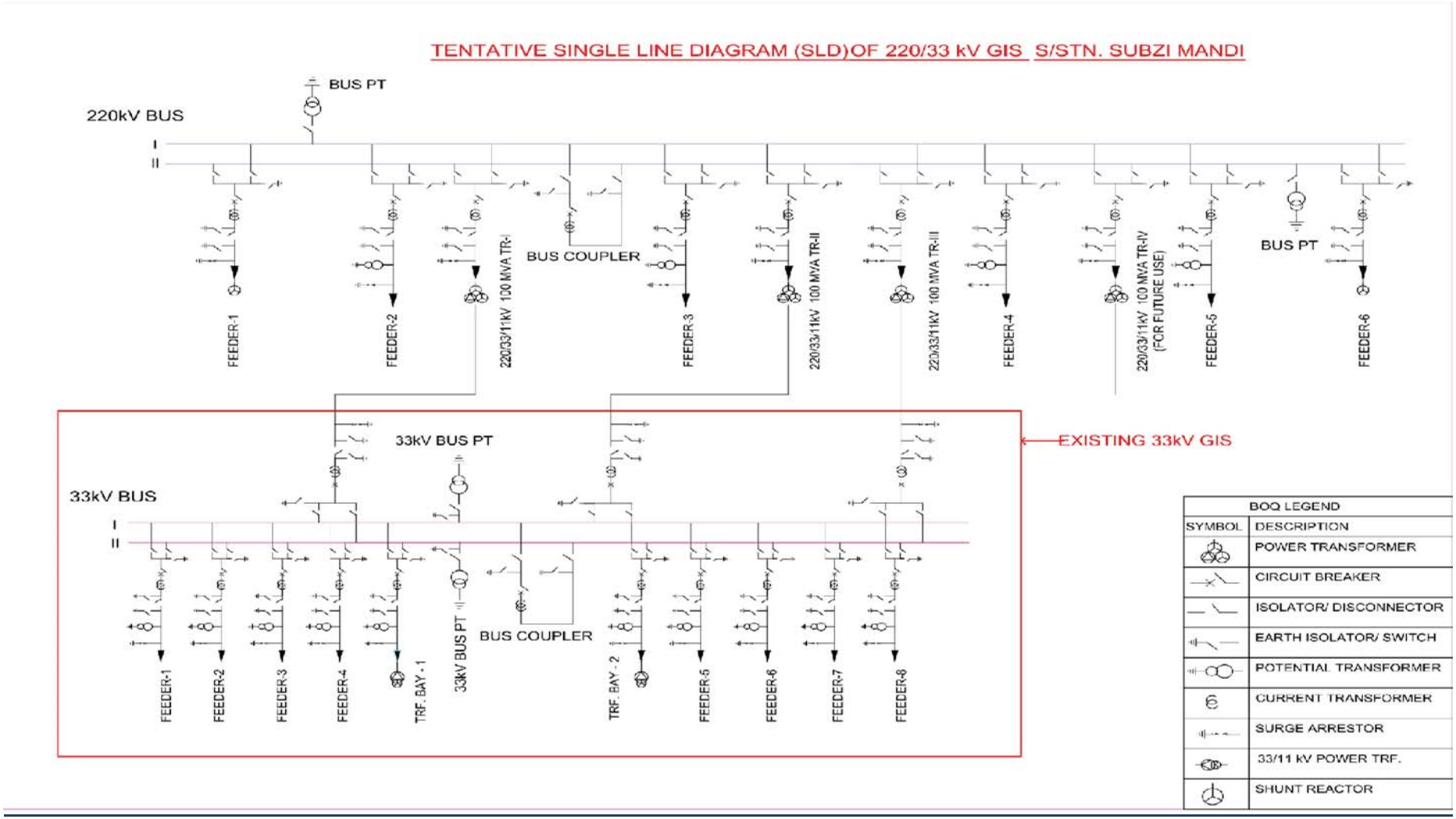
TITLE
TENTATIVE LAYOUT OF CONVERSION 220kV AIS YARD GIS AT 220/33kV SABJI MANDI SUSTATION

DRG NO.	SHEET NO.	REV.
SCALE N.T.S.	DATE	
DRAWN BY DEEPAK TYAGI	CHECKED BY	

Control Room cum Admin. Building



SINGLE LINE DIAGRAM



MAIN & INSTRUMENTS

Pre Bid Tie up for,

Design, Engineering, Supply, Erection*, Testing & Commissioning of 220 kV GIS at 220 kV Subzi Mandi Substation on turnkey basis.

*** - only supervision of Erection will be in bidder's scope.**

Sl. No.	Item Description	Unit	Qty.	Remarks
1	**Supply- GIS: 220kV, 50kA for 1sec, Gas Insulated Switchgear (GIS) as per TS**			
1.01	SUPPLY- GIS: 220KV, 2500 A, SF6 GAS INSULATED BUS BAR MODULE	SET	2	Module description as per Technical Specification, Cl. 3.0, (I), (A) of Section 1 : Project. Each set shall also include GIS interface module as per Section-2: Gas Insulated Switchgear, clause 5.43 suitable for future extension of GIS.
1.02	SUPPLY- GIS: 220KV, 2500 A, SF6 GAS INSULATED BUS COUPLER FEEDER BAY MODULE	SET	1	Module description as per Technical Specification, Cl. 3.0, (I), (B) of Section 1 : Project
1.03	SUPPLY- GIS: 220KV, 1600 A, SF6 GAS INSULATED TRANSFORMER FEEDER BAY MODULE	SET	4	Module description as per Technical Specification, Cl. 3.0, (I), (C) of Section 1 : Project
1.04	SUPPLY- GIS: 220KV, 1600 A, SF6 GAS INSULATED GIS LINE FEEDER BAY MODULE	SET	6	Module description as per Technical Specification, Cl. 3.0, (I), (D) of Section 1 : Project
1.05	SUPPLY- GIS : 220KV, 1600 A, SINGLE PHASE SF6 TO AIR BUSHING OUTSIDE GIS HALL (INCLUDING SF6 GAS, SUPPORT STRUCTURE & HARDWARES)	NO.	24	GIB outside wall of GIS Hall shall be considered for mode of measurement. Any GIB inside GIS hall (upto outer wall face of GIS Hall) shall be considered as part of respective Feeder Bay and cost of the same shall be deemed to be included.
1.06	SUPPLY- GIS : 220KV, 1600A, SINGLE PHASE GAS INSULATED BUS DUCT OUTSIDE GIS HALL (INCLUDING SF6 GAS, SUPPORT STRUCTURE & HARDWARES)	MTR	350	Module description as per Technical Specification, Cl. 3.0, (I), (E) of Section 1 : Project. GIB outside wall of GIS Hall shall be considered for mode of measurement. Any GIB inside GIS hall shall be considered as part of respective Feeder Bay and cost of the same shall be deemed to be included.
1.07	SUPPLY- GIS: SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	Lot	1	Complete in all respect in full compliance to technical specification and requirements, excluding SF6 Gas for GIB which is included in the scope of respective BOQ item.
1.08	SUPPLY- GIS: STRUCTURE MATERIAL INCLUDING FOUNDATION BOLTS, EMBEDDED ITEMS, RAILS AND/ OR OTHER MATERIALS ETC.	Lot	1	Complete in all respect in full compliance to technical specification and requirements, excluding support structure & hardware material for GIB which is included in the scope of respective BOQ item. In the event of changes in present scope, payment shall be made on pro-rata basis of number of circuit breaker bays only.
1.09	SUPPLY- GIS: EARTHING MATERIALS INCLUDING HIGH FREQUENCY EARTHING, AS APPLICABLE	Lot	1	
1.10	GIS CABLE TERMINATION ENCLOSURE, INDOOR TYPE, SUITABLE FOR 220KV CABLE TERMINATION	NO.	6	Cable size 1Cx1200Sq.mm.
1.11	GIS CABLE TERMINATION ENCLOSURE, OUTDOOR TYPE, SUITABLE FOR 220KV CABLE TERMINATION	NO.	6	Cable size 1Cx1200Sq.mm.
2	**Supply- GIS: Testing & Maintenance Instruments as per TS**			
2.01	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: SF6 Gas filling and evacuating plant	Set	1	Please refer Section-2, clause 28 and relevant annexure for complete details.
2.02	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: SF6 Gas Analyser	Set	1	Please refer Section-2, clause 28 and relevant annexure for complete details.

Sl. No.	Item Description	Unit	Qty.	Remarks
2.03	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: SF6 gas leak detector	Set	1	Please refer Section-2, clause 28 and relevant annexure for complete details.
2.04	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Gas masks	Nos.	10	Please refer Section-2, clause 28 and relevant annexure for complete details.
2.05	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Partial Discharge Monitoring System	Set	1	Please refer Section-2, clause 28 and relevant annexure for complete details.
2.06	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Contact resistance meter	Set	1	Please refer Section-4, clause (iv) and relevant annexure for complete details.
2.07	SUPPLY- GIS: TESTING & MAINTENNACE INSTRUMENTS: Circuit Breaker operational Analyzer	Set	1	Please refer Section-4, clause (v) and relevant annexure for complete details.
3	**Supply- GIS: Special Tools & Tackles as per TS**			
3.01	SUPPLY- GIS: Deployment of all special tools and tackles required for erection, testing, commissioning and maintenance of equipment	Set	1	Please refer Annexure to Section-1 (PART B), Section 1 : Project, clause no. 9 for complete details

MANADATORY SPARES

Sl. No.	Item Description	Unit	Qty.	Remarks
4	**Spares-GIS: Manadtory Spares for 220kV, 50kA for 1sec, Gas Insulated Switchgear (GIS) as per TS**			
4.01	SUPPLY- GIS: SPARES: 220KV, GIS- Single phase, Cable end termination connection & enclosure, compatible with the main Circuit	Set	1	
4.02	SUPPLY- GIS: SPARES: 220KV, GIS- SF6 gas Pressure Relief Devices (03 nos. of each type)	Set	2	
4.03	SUPPLY- GIS: SPARES: 220KV, GIS- SF6 Pressure gauge cum switch OR Density monitors cum switch as applicable (3 nos. of each type) (1 set complete for 1 bay + bus bar, Bus duct+ CB)	Set	1	
4.04	SUPPLY- GIS: SPARES: 220KV, GIS- Coupling device with pressure gauge for connecting Gas handling plant including GIS & Cylinder both	Set	2	
4.05	SUPPLY- GIS: SPARES: 220KV, GIS- Rubber Gaskets, “O” Rings and Seals for SF6 gas of each type	Set	1	
4.06	SUPPLY- GIS: SPARES: 220KV, GIS- Molecular filter for SF6 gas with filter bags (20% of total quantity)	Lot	1	
4.07	SUPPLY- GIS: SPARES: 220KV, GIS- All types of Control Valves for SF6 gas of each type	Set	1	
4.08	SUPPLY- GIS: SPARES: 220KV, GIS- SF6 gas (20% of total quantity)	Lot	1	
4.09	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- For 3 phase Enclosure	Nos.	2	
4.10	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- For single phase enclosure	Nos.	3	
4.11	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- Bus Support insulator of each type for 3 phase/ single phase enclosure (5% of installed/ used population)	Lot	1	
4.12	SUPPLY- GIS: SPARES: 220KV, GIS- Covers along with all accessories necessary to close a compartment in case of dismantling of any part of the Enclosure to ensure the sealing of this compartment- SF6 to air bushing of each type rating including fixing arrangement	Nos.	3	

Sl. No.	Item Description	Unit	Qty.	Remarks
4.13	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Circuit Breaker pole complete of each type & rating complete with interrupter, main circuit, enclosure and Marshalling Box with operating mechanism	Nos.	3	
4.14	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Fixed, moving and arcing contacts including insulating nozzles(3 nos. of each type/ rating of CB)	Set	1	
4.15	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Rubber gaskets, `O' rings and seals for SF6 gas of each type	Set	1	
4.16	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Trip coil assembly with resistor as applicable (3 nos. of each rating of CB)	Set	2	
4.17	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Closing coil assembly with resistor as applicable (3 nos. of each rating of CB)	Set	2	
4.18	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Corona rings/ cover if applicable	Set	1	
4.19	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Relays, Power contactors, push buttons, timers & MCBs etc of each type & rating	Set	1	
4.20	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Closing valve assembly (3 nos. of each type)	Set	2	
4.21	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Trip valve assembly (3 nos. of each type)	Set	2	
4.22	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Auxiliary switch assembly (3 nos. of each type)	Set	1	
4.23	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Operation Counter (3 nos. of each type)	Set	1	
4.24	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Rupture disc (3 nos. of each type)	Set	1	
4.25	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- Spring operated closing mechanism, if applicable (1 nos. of each type)	Set	1	
4.26	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hydraulic operating mechanism with drive motor (3 nos. of each type)	Set	1	
4.27	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hydraulic filter (3 nos. of each type)	Set	1	
4.28	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hose pipe (3 nos. of each type)	Set	1	
4.29	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- N2 Accumulator (3 nos. of each type)	Set	1	
4.30	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure transducer (3 nos. of each type)	Set	1	
4.31	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Valves (3 nos. of each type)	Set	1	
4.32	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pipe length (copper & steel) (3 nos. of each size & type)	Set	1	
4.33	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure switches (3 nos. of each type)	Set	1	
4.34	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure gauge with coupling device (3 nos. of each type)	Set	1	
4.35	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Hydraulic oil (20% of total qty used)	Lot	1	

Sl. No.	Item Description	Unit	Qty.	Remarks
4.36	SUPPLY- GIS: SPARES: 220KV, Circuit Breaker- For Hydraulic Operated Mechanism, if applicable- Pressure Relief Device, (3 nos. of each type)	Set	2	
4.37	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Complete set of 3 nos. of single phase / one no. of 3-phase disconnector including main circuit, enclosure, driving mechanism.	Set	1	
4.38	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- 3 no. of single phase / one no of 3-phase Earthing switch including main circuit, enclosure, driving mechanism.	Set	1	
4.39	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Copper contact fingers for dis-connector male & female contact for one complete (3 phase) dis-connector of each type and rating.	Set	1	
4.40	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Copper contact fingers for earthing switch male & female contacts, for one complete (3 phase) earthing switch of each type and rating	Set	1	
4.41	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Open / Close contactor assembly, timers, key interlock for one complete (3 phase) dis-connector and (3 phase) earthing switch of each type and rating	Set	1	
4.42	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Push button switch.-each type, as applicable	Set	1	
4.43	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Limit switch and Aux. Switches for complete 3 phase equipment	Set	1	
4.44	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Motor with gear assembly for complete 3 phase equipment for Isolator	Set	3	
4.45	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Motor with gear assembly for complete 3 phase equipment for Earth Swicth	Set	1	
4.46	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Hinge pins for complete 3 phase equipment	Set	1	
4.47	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Relays, Power contactors, resistors, fuses, push buttons & MCBs (complete for one 3 phase equipment)	Nos.	3	
4.48	SUPPLY- GIS: SPARES: 220KV, Isolator & Earth Switch- Aux. switch assembly (complete) with 10 NO & 10 NC OR more contacts for both isolator & earth switch	Set	1	
4.49	SUPPLY- GIS: SPARES: 220KV, Current Transformer- Complete CT of each type and rating with packing.	Nos.	2	
4.50	SUPPLY- GIS: SPARES: 220KV, Current Transformer- Secondary bushing of each type	Set	2	
4.51	SUPPLY- GIS: SPARES: 220KV, Voltage Transformer- Complete PT of each type and rating	Nos.	1	
4.52	SUPPLY- GIS: SPARES: 220KV, Surge Arrestor- Complete LA of each type and ratings with insulating base, terminal connector, Surge counter & accessories	Nos.	1	
5	**Spares-GIS: Reference Unit Price for addition/ deletion of supply items of 220kV, 50kA for 1sec, Gas Insulated Switchgear (GIS) as per TS**			
	Unit Prices of Individual Equipment included here or in mandatory spares are required for any Addition/Deletion of Equipment and replacement of damaged items. Vendor to ensure that the unit prices have a logical relationship with prices of assemblies in main items. Quoting for unit prices is mandatory and shall be considered for evaluation			
5.01	SUPPLY- GIS: SPARES: 220KV, SINGLE PHASE BUS BAR	Mtrs	1	Complete in all respect.
5.02	SUPPLY- GIS: SPARES: 220KV, GIS METALLIC ENCLOSURE	Kgs	50	
5.03	SUPPLY- GIS: SPARES: 220KV, EXPANSION BELLOWS/ JOINTS	Set	1	For Single Phase of any type and any rating.
5.04	SUPPLY- GIS: SPARES: 220KV, TEE BEND	Set	1	For Single Phase of any type and any rating.
5.05	SUPPLY- GIS: SPARES: 220KV, ANGLE BEND	Set	1	For Single Phase of any type and any rating.
5.06	SUPPLY- GIS: SPARES: 220KV, L-BEND	Set	1	For Single Phase of any type and any rating.

Sl. No.	Item Description	Unit	Qty.	Remarks

SERVICES

Sl. No.	Item Description	Unit	Qty.	Remarks
6	**Services- GIS: 220kV, 50kA for 1sec, Gas Insulated Switchgear (GIS) as per TS**			
6.01	SERVICES- GIS: SUPERVISION OF ERECTION: 220KV, SF6 GIS BAY MODULE	SET	11	Supervision of erection of GIS system, complete in all respect including LCC and other accessories. It also includes supervision of unloading & verification of materials for proper storage at site. GIS bay having GIS circuit Breaker is counted as Bay Module.
6.02	SERVICES- GIS: TESTING & COMMISSIONING: 220KV, SF6 GIS BAY MODULE	SET	11	Testing and commissioning of complete GIS system, is to be executed by venfor. All testing instruments, kits, T&P etc. are to be arranged by contractor on returnable basis. Please refer relevant section of technical specification for details. GIS bay having GIS circuit Breaker is counted as Bay Module.
6.03	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF 1 PHASE, SF6 TO AIR BUSHING	NO.	24	
6.04	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF 1 PHASE, SF6 TO AIR BUSHING	NO.	24	
6.05	SERVICES- GIS : 400KV, SUPERVISION OF ERECTION OF 1 PHASE GAS INSULATED BUS DUCT	MTR	350	Single-phase Bus duct.
6.06	SERVICES- GIS : 400KV, TESTING & COMMISSIONING OF 1 PHASE GAS INSULATED BUS DUCT	MTR	350	Single-phase Bus duct.
6.07	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS CABLE TERMINATION ENCLOSURE, INDOOR TYPE	NO.	6	
6.08	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS CABLE TERMINATION ENCLOSURE, INDOOR TYPE	NO.	6	
6.09	SERVICES- GIS : 220KV, SUPERVISION OF ERECTION OF GIS CABLE TERMINATION ENCLOSURE, OUTDOOR TYPE	NO.	6	
6.10	SERVICES- GIS : 220KV, TESTING & COMMISSIONING OF GIS CABLE TERMINATION ENCLOSURE, OUTDOOR TYPE	NO.	6	
6.11	SERVICES- GIS: SF6 GAS REQUIRED FOR PLACING GIS INTO SUCCESSFUL OPERATION	Lot	1	
6.12	SERVICES- GIS: FINAL SUCCESSFUL HV/ POWER FREQUENCY TESTING OF GIS INCLUDING ARRANGING OF HV TEST KIT ALONG WITH OPERATOR	Lot	1	Carrying out successful HV/ Power Frequency Testing of complete GIS as per IEC including Arrangement of HV Test kit (on returnable basis) shall be in scope of bidder, which includes charges HV test kit with operator, accessories & tools required for completion of HV testing. Bays may be commissioned separately.
6.13	SERVICES- GIS: INSULATION CO-ORDINATION STUDIES GIS SYSTEM COMPLETE	LOT	1	Insulation Coordination system report includes VFTO report.
7	**Services-GIS: Reference Unit Price for addition/ deletion of supply items of 220kV, 50kA for 1sec, Gas Insulated Switchgear (GIS) as per TS**			
7.01	SERVICES- GIS : REFERENCE UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR SUPERVISION OF ERECTION OF GIS	MAN-DAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
7.02	SERVICES- GIS : REFERENCE UNIT PRICE OF GIS INDIVIDUAL ITEM/ EQUIPMENT - SERVICES FOR TESTING & COMMISSIONING OF GIS	MAN-DAY	10	Charges for repetition of services - (if required due to reasons not attributed to the contractor) This item will be executed only if repetition of services is required by BHEL.
7.03	SERVICES- GIS : REFERENCE UNIT OF GIS INDIVIDUAL ITEM/ EQUIPMENT - HIRING CHARGES OF HV TEST KIT WITH OPERATOR	LOT	1	Additional HV test kit charges including charges of operator, HV test kit, accessories & tools required for completion of HV test (Dielectric Test after installation of GIS). This item is executed only if repetition/ additional HV Test is required by BHEL i.e. post successful commissioning of GIS. (if required due to reasons not attributed to the contractor)
8	**Services-GIS: Training of customer/ owner Personnel as per TS**			
8.01	Service: Training- Training in Design, Manufacturing and Testing of equipment/ GIS being supplied at manufacturer's works/ facility	MAN-DAY	120	Please refer Section 1- Annexuire Section 1 : Project, clause no. 12.1 for complete details

SECTION-2:

GAS INSULATED SWITCHGEAR

Technical Specification of 400kV, 220kV, 66kV, 33kV Gas Insulated Switchgear (GIS)

1. General

The GIS manufacturer shall design, manufacture, test, deliver and guarantee the GIS components and services as defined in this Technical Specification. The complete GIS based on the Single Line Diagram and as defined in Section Project, shall be provided for connection to Power Transformers/Reactors/Lines feeders with associated circuit breaker, disconnect switch and grounding switch (maintenance and high speed), instrument transformers, and surge arrestor (if applicable) etc.

2. GENERAL CHARACTERISTICS

2.1 The SF6 gas insulated metal enclosed switchgear shall be totally safe against inadvertent touch of any of its constituent parts. It should be designed for indoor application with meteorological conditions as specified.

2.2 All parts of the bus bar, switchgear and the bus ducts (for both indoor and outdoor applications) shall be as mentioned below:

400 kV GIS	Single phase enclosed
220 kV GIS	Single Phase/Three Phase enclosed
66 kV/33kV GIS	Three Phase enclosed

2.3 The design should be such that all parts subjected to wear and tear are easily accessible for maintenance purposes. The equipment offered shall be protected against all types of voltage surges and any equipment necessary to satisfy this requirement shall deemed to be included. The required overall system parameters of GIS are as per **Annexure -6**

3. REFERENCE STANDARDS

The GIS offered shall confirm to IEC 62271-203 and other relevant IEC standard except to the extent explicitly modified in the specification and shall be in accordance with requirement specified in GTR.

The metal-enclosed gas-insulated switchgear, including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be designed, manufactured, assembled and tested in accordance with the following International Electro-technical Commission (IEC) Publications including their parts and supplements as amended or revised as on date of bid opening

IEC 62271-203	Gas Insulated metal-enclosed switchgear for rated voltages above **5**2 kV
IEC 62271-207	Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
IEC 60376	New sulphur hexafluoride
IEC 62271-100	High voltage alternating current Circuit breakers
IEC 62271-1	Common clauses for high voltage Switchgear and control-

	gearStandards
IEC 62271-102	Alternating current Disconnect Switch (isolators) and earthing switches
IEC 61869	General Requirements Instrument Transformers
IEC 60137	Bushings for alternating voltages above 1000 V
IEC 62271-209	Cable connections for gas-insulated switchgear
IEC 60480	Guide to checking of sulphur hexafluoride taken from electrical equipment
IEC 60099 -1/4	Non-linear resistor type arresters for AC systems
IEC 60439	Factory-built assemblies of low-voltage switchgear and control Gear.
IEEE 80 2013	IEEE Guide for Safety in AC Substation grounding.
CIGRE-44	Earthing of GIS- an application guide. (Electra no.151,Dec'93).
IEC 62271-211	Direct connection between Power Transformers and gas insulated metal enclosed switchgear for rated voltage 72.5 kV and above.

The components and devices which are not covered by the above standards shall conform to, and comply with, the latest applicable standards, rules, codes and regulations of the internationally recognized standardizing bodies and professional societies as may be approved by the Employer. The manufacturer shall list all such applicable standards, codes etc and provide copies thereof for necessary approval.

In case the requirements laid down herein differ from those given in above standard in any aspect, the switchgear shall comply with the requirements indicated herein in regard thereto.

4. DEFINITIONS

4.1. **Assembly:** Assembly refers to the entire completed GIS equipment furnished undercontract.

4.2. **Bay:** Bay refers to the area occupied by one Circuit Breaker and associated equipment used toprotect one feeder/line/bus coupler in double bus scheme.

4.3. **Compartment:** When used in conjunction with GIS equipment, compartment refers to a gastight volume bounded by enclosure walls and gas tight isolating barriers.

4.4. **Enclosure:** When used in conjunction with GIS equipment, enclosure refers to the groundedmetal housing or shell which contains and protects internal Power system equipment (breaker, disconnecting switch, grounding switch, voltage transformer, current transformer, surge arresters, interconnecting bus etc.)

4.5. **Manual Operation:** Manual operation means operation by hand without using any othersource of power.

4.6. **Module:** When used in conjunction with GIS equipment, module refers to a portion of thatequipment. Each module includes its own enclosure. A module can contain more than one piece of equipment, for example, a module can contain a disconnecting switch and a grounding switch.

4.7. **Reservoir**: When used in conjunction with GIS equipment reservoir refers to a larger gas-tight volume.

5. GENERAL DESIGN AND SAFETY REQUIREMENT

5.1. The GIS shall be designed, manufactured and tested in accordance with the best international engineering practices under strict quality control to meet the requirement stipulated in the technical specification. Adequate safety margin with respect to thermal, mechanical, dielectric stress and insulation coordination etc. shall be maintained during design, selection of raw

material, manufacturing process etc. so that the GIS provides long life with least maintenance.

The workmanship shall be of the highest quality and shall conform to the latest modern practices for the manufacture of high technology machinery and electrical switchgear.

5.2. The GIS assembly shall consist of separate modular compartments e.g. Circuit Breaker compartment, Bus bar compartment filled (single phase design) with SF6 Gas and separated by gas tight partitions so as to minimize risk to human life, allow ease of maintenance and limit the effects of gas leaks failures & internal arcs etc. These compartments shall be such that maintenance on one feeder may be performed without de-energising the adjacent feeders. These compartments shall be designed to minimize the risk of damage to adjacent sections and protection of personnel in the event of a failure occurring within the compartments. Rupture diaphragms with suitable deflectors shall be provided to prevent uncontrolled bursting pressures developing within the enclosures under worst operating conditions, thus providing controlled pressure relief in the affected compartment.

5.3. The switchgear, which shall be of modular design, shall have complete phase isolation. The conductors and the live parts shall be mounted on high graded epoxy resin insulators. These insulators shall be designed to have high structural strength and electrical dielectric properties and shall be free of any voids and free of partial discharge at a voltage which is at least 5% greater than the rated voltage. These shall be designed to have high structural and dielectric strength properties and shall be shaped so as to provide uniform field distribution and to minimize the effects of particle deposition either from migration of foreign particles within the enclosures or from the by-products of SF6 breakdown under arcing conditions.

5.4. All circuit breakers disconnect switches and other component of GIS having identical rating shall have identical and interchangeable parts and operating mechanism as far as possible.

5.5. Gas barrier insulators and support insulators shall have the same basis of design. The support insulators shall have holes on both sides for proper flow of gas.
Gas barrier insulators shall be provided so as to divide the GIS into separate compartments. These shall be suitably located in order to minimize disturbance in case of leakage or dismantling. They shall be designed to withstand any internal fault thereby keeping an internal arc inside the faulty compartment. Further, it is prohibited to work adjacent to a gas Compartment while it is fully pressurized on the other side. For such cases, the gas pressure in the adjacent compartments needs to be reduced.
Due to safety requirement for working on this pressurized equipment, whenever the pressure of the adjacent gas compartment is reduced during maintenance, this compartment shall be designed so that it shall remain in service to perform its intended duty. The gas tight barriers shall be clearly marked on the outside of the enclosures.
The bus enclosure should be sectionalized in a manner that maintenance work on any bus disconnector (when bus and bus disconnector are enclosed in a single enclosure) can be carried out by isolating and evacuating the small effected section and not the entire bus. The design of GIS shall be such that in case a circuit breaker module of a feeder is removed for maintenance, both busbars shall remain in service. For achieving the above requirements, adequate Mechanical support and number of intermediate gas tight compartments as required, shall be provided to ensure equipment and operating personnel's safety.

5.6. The switchgear shall be of the free standing, self-supporting with easy accessibility to all the parts during installation & maintenance with all high-voltage equipment installed inside gas-insulated metallic and earthed enclosures. GIS should be suitably sub-divided into individual arc and gas-proof compartments preferably for:

i. Bus bars
ii. Intermediate compartment

iii. Circuit breakers
iv. Feeder Disconnect Switch
v. Voltage Transformers
vi. Gas Insulated bus duct section between GIS and XLPE cable/Overhead Conductor.
vii. Gas Insulated bus section between GIS & Oil filled Transformer/ Reactor (if applicable)

5.7. **Service continuity requirement:**

The GIS equipment with the given bus switching arrangement is divided into different gas compartments. During the work such as a fault repair or major maintenance, requiring the dismantling of a gas compartment for which more than one compartments may need to be de-gassed.

Working conditions, method statements and procedures are to be furnished by the GIS manufacturer in order to ensure equipment and operating personnel's safety and to achieve following service continuity conditions to the extent possible:

5.7.1. For One & half breaker bus switching scheme during a fault in CB compartment, No bus bar and feeder is permitted out of service during maintenance and repair/replacement.

5.7.2. For Double Main bus switching scheme during a fault in CB compartment, No bus bar permitted out of service during maintenance and repair/replacement.

5.7.3. During a fault in GIS compartment other than CB compartment, maximum one bus bar and/or one feeder permitted out of service during maintenance and repair/replacement.

5.8. The material and thickness of the enclosures shall be such as to withstand an internal flash over without burns through for a period of 300 ms at rated short time withstand current. The material shall be such that it has no effect of environment as well as from the by-products of SF6 breakdown under arcing condition. This shall be validated with Type Test.

5.9. Each section shall have plug- in or easily removable connection pieces to allow for easy replacement of any component with the minimum of disturbance to the remainder of the equipment. Inspection windows (View Ports) shall be provided for Disconnect Switch and both type of earth switches i.e. Maintenance and fast operating.

5.10. The material used for manufacturing the switchgear equipment shall be of the type, composition and have physical properties best suited to their particular purposes and in accordance with the latest engineering practices. All the conductors shall be fabricated of aluminum/ copper tubes of cross sectional area suitable to meet the normal and short circuit current rating requirements. The finish of the conductors shall be smooth so as to prevent any electrical discharge. The conductor ends shall be silver plated and fitted into finger contacts or tulip contacts. The contacts shall be of sliding type to allow the conductors to expand or contract axially due to temperature variation without imposing any mechanical stress on supporting insulators.

5.11. Each pressure filled enclosure shall be designed and fabricated to comply with the requirements of the applicable pressure vessel codes and based on the design temperature and design pressures as defined in IEC-62271-203.

5.12. The maximum SF6 gas leakage shall not exceed 0.5% (half percent) per year for the whole equipment and for any individual gas compartment separately. The SF6 gas leakage should not exceed 0.5% per year and the leakage rate shall be guaranteed for at least 10 years. In case the leakage under the specified conditions is found to be greater than 0.5% after one year of commissioning, the manufacturer will have to supply free of cost, the total gas requirement for subsequent ten (10) years, based on actual leakage observed during the first year of operation after commissioning.

5.13. Each gas-filled compartment shall be equipped with static filters, density switches, filling valve and safety diaphragm. The filters shall be capable of absorbing any water vapor which may penetrate into the enclosures as well as the by-products of SF6 during interruption. Each gas compartment shall be fitted with non-return valve connectors for evacuating & filling the gas and checking the gas pressure etc.

5.14. The switchgear when installed and operating under the ambient conditions shall perform satisfactorily and safely under all normal and fault conditions. Even repeated operations up to the permissible servicing intervals under 100% rated and fault conditions, shall not diminish the performance or significantly shorten the useful life of the switchgear. Any fault caused by external/internal reasons shall be positively confined to the originating compartment and shall not spread to other parts of the switchgear.

5.15. The thermal rating of all current carrying parts shall be minimum for one sec. for the rated symmetrical short-circuits current.

5.16. The arrangement of the individual switchgear bays shall be such so as to achieve optimum space-saving, neat and logical arrangement and adequate accessibility to all external components.

5.17. The layout of the substation equipment, bus bars and switchgear bays shall preferably be based on the principle of “phase grouping”. Switchgear layout based on the “mixed phases” principle shall not be accepted without mutual agreement between supplier and employer. The arrangement of the equipment offered must provide adequate access for operation, testing, Repair and maintenance.

5.18. All the elements shall be accessible without removing support structures for routine inspections. The removal of individual enclosure parts or entire breaker bays shall be possible without disturbing the enclosures of neighboring bays and LCC panels.

5.19. It should not be possible to unwillingly touch live parts of the switchgear or to perform operations that lead to arcing faults without the use of tools or brute force. All interlocks that prevent potentially dangerous mal-operations shall be constructed such that they cannot be operated easily, i.e. the operator must use tools or brute force to over-ride them.

5.20. In general the contours of energized metal parts of the GIS and any other accessory shall be such, so as to eliminate areas or points of high electrostatic flux concentrations. The surfaces shall be smooth with no projection or irregularities which may cause visible corona. No corona shall be visible in complete darkness which the equipment is subjected to specified test voltage. There shall be no radio interference from the energized switchgear at rated voltage.

5.21. The GIS shall be designed, so as to take care of the VFT over voltages generated as a result of pre-strikes and re-strikes during isolator operation. Maximum VFT over voltages peak shall not be higher than rated lightning impulse withstand voltage (LIWV) of the equipment. Necessary measures shall be under taken by GIS manufacture to restrict maximum VFT over voltages lower than the LIWV. Manufacturer shall submit the study report of VFTO generated for GIS installation.

5.22. The enclosure shall be of continuous design and shall meet the requirement as specified in of IEEE 80 2013 (special considerations for GIS).

The enclosure shall be sized for carrying induced current equal to the rated current of the Bus. The conductor and the enclosure shall form the concentric pair with effective shielding of the field internal to the enclosure.

5.23. The fabricated metal enclosures shall be of Aluminum alloy having high resistance to corrosion, low electrical loses and negligible magnetic losses. All joint surfaces shall be machined and all castings shall be spot faced for all bolt heads or nuts and washers. All screws, bolts, studs and nuts shall conform to metric system.

5.24. The elbows, bends, cross and T-sections of interconnections shall include the insulators bearing the conductor when the direction changes take place in order to ensure that live parts remain perfectly centered and the electrical field is not increased at such points.

5.25. The enclosure shall be designed to practically eliminate the external electromagnetic field and thereby electro-dynamic stresses even under short circuit conditions. The average intensity of electromagnetic field shall not be more than 50 micro Tesla on the surface of the enclosure. The contractor shall furnish all calculations and documents in support of the above during detailed engineering.

5.26. The switchgear shall have provision for connection with ground mat risers through copper connections. This provision shall consist of grounding pads to be connected to the ground mat riser in the vicinity of the equipment.

5.27. Stairs, fixed ladder, platforms, and walkways for operation and maintenance access to the operating mechanism and monitoring devices should be provided to permit access. The structures shall be either aluminum or hot-dipped galvanized steel. All structures, stairs, platforms, and walkways shall conform to the relevant occupational health and safety regulations and designed in accordance with the latest industry standards and guidelines. The platforms and walkways shall have anti-skid surfaces that can be walked on. Handrails shall be provided where necessary. The GIS supplier shall provide 3-D arrangement drawing to show the location of equipment and access to it.

5.28. In addition to above suitable portable scissor lift shall be provided for access of distant portion of GIS installation.

5.29. New Gasket, sealant and desiccant shall be installed for permanent sealing of all site/field assembled joints. No gaskets are to be reused for any permanent seal broken or disturbed in the field/site.

5.30. The enclosure & support structure shall be designed such that person of 1780 mm in height and 80 Kg in weight is able to climb on the equipment for maintenance.

5.31. The sealing provided between flanges of two modules / enclosures shall be such that long term tightness is achieved.

5.32. Alarm circuit shall not respond to faults for momentary conditions. The following indications including those required elsewhere in the specifications shall be generally provided in the alarm and indication circuits.

Gas Insulating System:

i) Loss of Gas Density
ii) Any other alarm necessary to indicate deterioration of the gas insulating system.

Operating System:

i) Low operating pressure
ii) Loss of Heater power
iii) Loss of operating power
iv) Loss of control supply
v) Pole Discordance.

5.33. The equipment will be operated under the following ambient conditions (or as defined in the section project):

a) The ambient temperature varies between 0 degree-C and 50 degree-C. However, for design purposes, ambient temperature should be considered as 50 degree-C.
b) The humidity will be about 95% (indoors)
c) The elevation is less than 1000 meters

5.34 Temperature rise of all current carrying parts and enclosures shall be limited to the values stipulated in IEC-62271-1, under rated current and the climatic conditions as specified. The temperature rise for accessible enclosure shall not exceed 20 degree C above the ambient temperature of 50 degree C.

5.35. Wherever required, the heaters shall be provided for the equipment in order to ensure the proper functioning of the switchgear at specified ambient temperatures. All cabinet heaters shall be rated for 240V AC (1-phase) supply and shall be complete with thermostat, control switches and fuses, connected as a balanced 3-phase 4-wire load. The heaters shall be so arranged and protected as to create no hazard to adjacent equipment from the heat produced.

5.36. **Bellows or Compensating Units:-**Adequate provision shall be made to allow for thethermal expansion of the conductors & enclosures and for differential thermal expansion between the conductors and the enclosures. The bellows metallic(preferably stainless steel) with suitable provision for permitting the movement during expansion and contraction may be provided and shall be of following types:.

1. Lateral / Vertical mounting units: These shall be inserted, as required, between sections of busbars, on transformer, shunt reactor and XLPE cable etc. Lateral mounting shall be made possible by a sliding section of enclosure and tubular conductors.
2. Axial compensators: These shall be provided to accommodate changes in length of busbars due to temperature variations.
3. Parallel compensators: These shall be provided to accommodate large linear expansions and angle tolerances.
4. Tolerance compensators: These shall be provided for taking up manufacturing, site assembly and foundation tolerances.
5. Vibration compensators: These bellow compensators shall be provided for absorbing vibrations caused by the transformers and shunt reactors when connected to SF6 switchgear by oil- SF6 bushings.

The electrical connections across the bellows or compensating units shall be made by means of suitable connectors. For sliding type compensators, markers/pointers shall be provided to observe expansion or contraction during climatic conditions.

5.37. **Indication and verification of switch positions**: Indicators shall be provided on all circuitbreakers, isolators and earth-switches, which shall clearly show whether the switches are open or closed. The indicators shall be mechanically coupled directly to the main contact operating drive rod or linkages and shall be mounted in a position where they are clearly visible from the floor or the platform in the vicinity of the equipment.

Inspection windows shall also be provided with all isolators and earth switches so that the switch contact positions can be verified by direct visual inspection.

5.38. **Pressure relief device**: Pressure relief devices shall be provided in the gas sections toprotect the gas enclosures from damage or distortion during the occurrence of abnormal pressure increase or shock waves generated by internal electrical fault arcs (preferably in downward direction).

Pressure relief shall be achieved either by means of diaphragms or plugs venting directly into the atmosphere in a controlled direction.

If the pressure relief devices vent directly into the atmosphere, suitable guards and deflectors shall be provided. Contractor shall submit to the owner the detailed criteria design regarding location of pressure relief devices/rupture diaphragms.

5.39. **Pressure vessel requirements**: The enclosure shall be designed for the mechanical andthermal loads to which it is subjected in service. The enclosure shall be manufactured and tested according to the Pressure Vessel Code (ASME/CENELEC code for pressure Vessel.)

The bursting strength of Aluminum castings has to be at least 5 times the design pressure. A bursting pressure test shall be carried out at 5 times the design pressure as a type test on each type of enclosure.

Each enclosure has to be tested as a routine test at 1.5 times the design pressure for one minute.

5.40. **Grounding:**

5.40.1. The grounding system shall be designed and provided as per IEEE-80-2013 and CIGRE-44 to protect operating staff against any hazardous touch voltages and electro-magnetic interferences.

5.40.2 The GIS supplier shall define clearly what constitutes the main grounding bus of the GIS. The contractor shall supply the entire material for grounding bus of GIS viz conductor, clamps, joints, operating and safety platforms etc. The contractor is also required to supply all the earthling conductors and associated hardware material for the following:

1. Connecting all GIS equipment, bus ducts, enclosures, control cabinets, supporting structure etc. to the ground bus of GIS.
2. Grounding of transformer, CVT/VT, SA and other outdoor switchyard equipments/structures etc.

5.40.3. The enclosure of the GIS may be grounded at several points so that there shall be grounded cage around all the live parts. A minimum of two nos. of grounding connections should be provided for each of circuit breaker, cable terminals, surge arrestors, earth switches and at each end of the bus bars. The grounding continuity between each enclosure shall be effectively interconnected either internally or externally with Copper/Aluminum bonds of suitable size to bridge the flanges. Subassembly to subassembly bonding shall be provided to bridge the gap & safe voltage gradients between all intentionally grounded parts of the GIS assembly & between those parts and the main grounding bus of the GIS.

5.40.4. Each marshaling box, local control panel, power and control cable sheaths and other non-current carrying metallic structures shall be connected to the grounding system of GIS via connections that are separated from GIS enclosures.

5.40.5. The grounding connector shall be of sufficient mechanical strength to withstand electromagnetic forces as well as capable of carrying the anticipated maximum fault current without overheating. At least two grounding paths shall be provided to connect each point to the main grounding bus. Necessary precautions should be under taken to prevent excessive currents from being induced into adjacent frames, structures of reinforcing steel and to avoid establishment of current loops via other station equipment.

5.40.6. All flexible bonding leads shall be tinned copper. All connectors, for attaching flexible bonding leads to grounding conductors and grounding conductors to support structures shall be tinned bronze with stainless steel or tinned bronze hardware.

5.40.7. The contractor shall provide suitable measure to mitigate transient enclosure voltage caused by high frequency currents due to by lightning strikes, operation of surge arrestor, phase to earth fault and discharges between contacts during switching operation. The grounding system shall ensure safe touch & step voltages in all the enclosures. The contractor shall provide suitable barrier of non-linear resistor/ counter discontinued SF6/ Air termination, SF6/ Transformer or Reactor termination, SF6/ HV cable bushing etc. to mitigate transient enclosure voltage.

5.40.8 The bidders shall provide lightening mast/GS shield wire at suitable place for protection of whole sub-station including transformers, GIS cum control room building etc. The bidder shall submit detailed proposal for grounding system of whole substation including indoor and outdoor equipments with Earthmat using 40mm. dia MS rod for approval of purchaser. The riser shall be GS flat of size 75X12mm for outdoor equipments and 50X6mm for indoor.

The bidder shall submit detailed proposal for grounding system for approval of purchaser. Any provision to be made in the building design to take care of earthing requirement shall also be clearly spelt-out.

5.41. **UHF sensors for PD detection**:

Adequate number of UHF sensors shall be provided in the offered GIS for detection of Partial discharge (of 5 pC and above) as per IEC 60270. The number and location of these sensors shall be based on laboratory test on typical design of GIS as per recommendations of CIGRE Document No. 654 (*APPLICATION GUIDE FOR SENSITIVITY VERIFICATIONfor UHF PARTIAL DISCHARGE DETECTION SYSTEM FOR GIS*). Offered numbers andlocation of UHF sensors shall be submitted based on above said criteria along with attenuation calculation for approval of the employer. Further UHF sensors shall necessarily be provided in close proximity to VT compartments.

However adequacy of number of sensors and their location shall be verified at site as per recommendations of above CIGRE Document No. 654. In case during site testing, additional UHF sensors are required, the same shall also be supplied & installed to complete the technical requirement.

The calibration and frequency response of PD couplers shall be as per NGC Technical Guidance note TGN (T) 121, issue 1, 1997. Data sheet shall be submitted for the UHF couplers meeting this requirement.

5.42. **Gas Insulated Bus (GIB) layout :**

GIB shall be designed based on the following criteria

(1) Maximum weight of gas in a gas tight section of GIB shall not exceed 400 kg (for 400 kV)/ 250 kg (for 220 kV, 66 kV &33 kV).

(2) GIB shall be generally in horizontal layer. However in exceptional circumstance GIB in vertical layers can be provided with the approval of employer.

(3) The minimum vertical ground clearance of GIB at road crossing shall be 5.5 meters

(4) The horizontal clearance between GIB and GIS building /any other building wall shall be preferably three (3) meters.

(5) The GIB route inside the GIS Hall shall not obstruct easy access to GIS and control room buildings and shall not obstruct movement of crane, equipment including HV test equipment for maintenance works.

(6) The GIB clear height outside the GIS hall in switchyard area shall be minimum 3.5 meter, so as not to obstruct easy access to GIB, movement of crane for maintenance work.

(7) Optimization of outdoor GIB length using overhead AIS connection with Bus Post Insulator of respective voltage class is generally acceptable subject to meeting the electrical clearances as stipulated.

(8) For the maintenance of GIB of one circuit, only that circuit shall be isolated. Adequate clearance between bus ducts of two circuit shall be ensured by the contractor during layout finalization.

(9) GIS manufacturer as per their design shall preferably use maximum three standard straight horizontal outdoor bus duct lengths for entire GIS installation to optimize the spare requirement.

(10) The minimum outer to outer horizontal clearance between each GIS bus duct shall be 0.5 meter for 400kV, 220 kV, 66 kV & 33kV voltage level.

5.43. **Extension of GIS**

5.43.1. The arrangement of gas sections or compartments shall be such as to facilitate future extension of any make without any drilling, cutting or welding on the existing equipment. To add equipment, it shall not be necessary to move or dislocate the existing switchgear bays.

5.43.2. As the GIS is likely to be extended in future, during detailed engineering stage, the contractor shall make available the complete design detail of interface module such as cross section, enclosure material, enclosure dimensions (inner & outer), Flange diameter (inner & outer), conductor cross-section & connection arrangement, bolt spacing & dimension, rated gas pressure, Gasket detail etc. Further GIS manufacturer supplying GIS under present scope shall furnish all the required details in addition to mentioned above necessary for design and successful implementation of an interface module during later stage while extending GIS by any other GIS manufacturer, without any help of GIS manufacturer who has supplied the GIS equipment in present scope.

5.43.3. The Interface module shall be designed to provide Isolating link with access hole on enclosure. The Isolating link shall be provided in such a way so that HV test can be performed on either side of the interface module separately, keeping other side of GIS remained isolated. Interface Module drawing with necessary detail shall be submitted for approval.

5.43.4. Further the contractor who is extending the existing GIS installation, it shall be his responsibility to provide interface module matching with the existing GIS interface module. The drawing of existing GIS interface/end piece module shall be provided by the employer. However it shall be the responsibility of contractor to verify the existing details during site visit.

5.43.5. The Contractor shall optimally utilize the space inside the GIS hall (including the extension portion) for accommodating the interface module being supplied under the contract and the space (along the length of the hall) inside the GIS hall for interface module shall preferably be limited to 1 meter for 400/220/66/33kV.

5.44. **SF6 GAS**

The SF6 gas insulated metal-clad switchgear shall be designed for use with SF6 gas complying with the recommendations of IEC 60376, 60376A & 60376B, at the time of the first charging with gas. All SF6 gas supplied as part of the contract shall comply with the requirements of IEC & should be suitable in all respects for use in the switchgear under all operating conditions. Necessary statutory clearances from concerned authorities for import of the Gas and for storage of the Gas shall be obtained.

The high pressure cylinders in which SF6 gas is supplied & stored at site shall comply with the requirements of following standards & regulations:

IS : 4379 Identification of the contents of industrial gas cylinders.

IS : 7311 Seamless high carbon steel cylinders for permanent & high pressureliquefiable gases. The cylinders shall also meet latest Gas Cylinder Rules (PESO)

SF6 gas shall be tested for purity, dew point, air, hydrolysable fluorides and water contents as per IEC: 60376, 60376A & 60376B and test certificates shall be furnished to the Employer indicating all test results as per IEC standards for each lot of SF6 gas. Further site tests for dew point and purity shall be done during commissioning of GIS. Gas bottles should be tested for leakage during receipt at site.

The contractor shall indicate diagnostic test methods for checking the quality of gas in the

various sections of GIS during service. The method proposed shall have as a minimum check the moisture content & the percentage of purity of the gas on annual basis.

The contractor shall also submit clearly the precise procedure to be adopted by maintenance personnel for handling equipment that are exposed to the products of arcing in SF6 Gas so as to ensure that they are not affected by possible irritants of the skin and respiratory system. Recommendations shall be submitted for suitable protective clothing, method of disposal of cleaning utensils and other relevant matters.

The contractor shall also indicate the details and type of filters used in various gas sections, and should also submit the operating experience with such filters.

5.44.1. **SF6 gas monitoring devices and alarm circuits:** Dial type temperature compensated gasdensity monitoring devices with associated pressure gauge will be provided. The devices shall provide continuous & automatic monitoring of gas density. A separate device shall be provided for each gas tight compartment so that it can be monitored simultaneously as follows:-

Compartment/ Sl. No.	Compartments except CB	Circuit Breaker compartments
1	**"Gas Refill level:** This will be used to annunciate the need for the gasrefilling. The contractor shall provide a contact for remote indication.	**'Gas Refill' level :**This will be used toannunciate the need for gas refilling.The contractor shall provide a contactfor remote indication.
2	**"SF6 low level" :**This will be used to annunciate the need for urgent gasfilling . A contact shall be provided for remote indication	**"SF6 low level" :**This will be used toannunciate the need for urgent gasfilling . A contact shall be providedfor remote indication
3	**'Zone Trip' level:** This is the minimum level at which the Manufacturer will guarantee theinsulation rating of the assembly.	**Breaker Block' level :**This is the minimum gas density atwhich the manufacturer will guaranteethe rated fault interrupting capabilityof the breaker .At this level thebreaker block contact shall operateand the closing & tripping circuit shallbe blocked.
4	**Not Applicable**	**'Zone Trip' level:** This is theMinimum level at which the manufacturer will guarantee the insulation rating of the assembly.

The density monitor/pressure switch contacts shall be in accordance with the above requirement.

It shall be possible to test all gas monitoring relays/devices without de-energizing the primary equipment & without reducing pressure in the main section. It shall also damp the pressure pulsation while filling the gas in service, so that flickering of the pressure switch contacts does not take place.

5.44.2. **Gas Supply:** The contractor shall include the supply of all SF6 gas necessary for filling &putting into operation the complete switchgear installation being supplied. The empty gas cylinders shall be returnable to the contractor.

5.45. **Documentation**

The contractor shall prepare and submit to the employer, drawings; details that show the GIS design in order for the employer to verify the equipment conform to the specifications. The Design Document to be submitted for review and approval are as follows:

i. Design Review Document as per clause no. **19** of this specification
ii. Single Line Diagram
iii. Gas Schematic Diagram
iv. GTP-Guaranteed Technical Particulars
v. GIS layout (Plan and Section) including 3D drawing
vi. GIS Component Drawings
vii. Interface modules drawing for GIS extension
viii. Rating and Name Plate Drawing
ix. GIS/LCC Schematics Drawing
x. Foundation loading plan and detail
xi. GIS Support Structure Drawing
xii. GIS platforms and Walkway Drawing
xiii. GIS grounding plan and details along with design calculation for GIS grounding
xiv. GIS key Diagram enlisting and marking each and every GIS Module clearly and separately identifiable (indoor and outdoor). This separately identified module shall be complete along with its enclosure, gasket and all active parts such as conductor, conductor joints, corona shield etc.
xv. Method Statement along with sequential instruction for dismantling and assembling of all major components of GIS exhibiting service continuity requirement
xvi. Type Test Reports
xvii. Seismic Analysis Report
xviii. Study report of VFTO generated for GIS installation for 400 kV
xix. The general arrangement drawing of interconnecting bus-duct from GIS bay module to XLPE cable termination end
xx. The general arrangement drawing of Terminal connection arrangement to connect GIS duct to SF6/Oil bushing and duct mounting arrangement details
xxi. Gas handling procedure
xxii. The design & construction proposal of the building along with necessary information, data, and drawings according to the complete requirements
xxiii. Capacity calculation of EOT crane for GIS hall considering a factor of safety of 5
xxiv. Method statement/ procedure of ON SITE high voltage testing with PD measurement and Switching Impulse test.

xxv. **Additional CB data to be furnished during detailed engineering :**
   a) Design 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.
   b) Curves supported by test data indicating the opening time under close open operation with combined variation of trip coil voltage and hydraulic pressure.
   c) Contact Travel: Operating mechanism operating shaft travel and contact overlap of Circuit Breaker to be provided.

xxvi. PD Monitoring System
   a) The technical proposal for PDM system along with detailed design documentation.
   b) Data sheet for the UHF couplers.

c) The Sub-station GIS layout as a separate drawing indicating position of spacers, spread over of PD sensors with distance, sensor identification, the detector unit identification etc., total numbers of offered UHF Sensors along with attenuation calculation.
d) Guaranteed Technical Particulars & Data Sheet for various components used in the PDM system.
e) Electromagnetic compatibility Test Reports.
f) List of critical spares.

xxvii. Installation and Operation & Maintenance Manual

6. CIRCUIT BREAKERS

6.1. **General :**SF6 gas insulated metal enclosed circuit breakers and accessories shall conformto IEC: 62271-100, IEC: 62271-1 and other relevant IEC standards except to the extent explicitly modified in the specification and shall also be in accordance with requirements specified in Section-GTR.

Circuit breakers shall be equipped with the operating mechanism. Circuit breakers shall be of single pressure type. Complete circuit breaker with all necessary items for successful operation shall be supplied. The circuit breakers shall be designed for high speed single and three phase reclosing (as applicable) with an operating sequence and timing as specified.

6.2. **Duty Requirements:** Circuit breaker shall be C2 - M2 class as per IEC 62271-100.

6.3 Circuit breaker shall meet the duty requirements for any type of fault or fault location also for line charging and dropping when used on effectively grounded system and perform make and break operations as per the stipulated duty cycles satisfactorily.

6.4. The circuit breaker shall be capable of:

1. Interrupting the steady and transient magnetizing current shall be as follows:
Interrupting the steady and transient magnetizing current corresponding to 400 kV/220 kV, 220/66 kV and 220/33 kV class transformers of500 MVA, 315MVA, 160 MVA and 100 MVA ratings on 400 kV, 220 kV, and 66 kV & 33kV side.

2. Interrupting line/cable charging current as per IEC without re-strikes and without use of opening resistors. The breaker shall be able to interrupt the rated line charging current as per IEC-62271-100 with test voltage immediately before opening equal to the product of $U/\sqrt{3}$ and 1.4.

3. Clearing short line fault (Kilometric faults) with source impedance behind the bus equivalent to symmetrical fault current specified.

4. Breaking 25% the rated fault current at twice the rated voltage under phase opposition condition.

5. The breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energisation of shunt reactor and/or series capacitor compensated lines with trapped charges.

6. Withstanding all dielectric stresses imposed on it in open condition at lock out pressure continuously (i.e. shall be designed for 2 p.u. across the breaker continuously, for validation of which a power frequency withstand test conducted for a duration of at least 15 minutes is acceptable).

7. Circuit breakers shall be able to switch in and out the shunt reactor as detailed below:

Voltage Level	Reactor Rating (in MVAR)	Max. rise of overvoltage (in p.u.)
400 kV	50 to 125	2.3
220 kV	25 to 50	2.3

6.5. **Total Break Time :**The total break time shall not be exceeded under any of the followingduties :

a) Test duties T10,T30,T60,T100 (with TRV as per IEC- 62271-100)

b) Short line fault L90, L75 (with TRV as per IEC-62271-100)

The Contractor 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 (70-110%), hydraulic pressure and SF6 gas pressure etc. While furnishing the proof for the total break time of complete circuit breaker, the contractor may specifically bring out the effect of non-simultaneity between poles and show how it is covered in the total break time.

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

6.6. **Constructional features :**

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

6.6.1. 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 rating of the grading elements shall be adequate for the service conditions and duty specified.

6.6.2. **Contacts:** All making and breaking contacts shall be sealed and free from atmosphericeffects. Contacts shall be designed to have adequate thermal and current carrying capacity for the duty specified and to have a life expectancy so that frequent replacement due to excessive burning will not be necessary. Provision shall be made for rapid dissipation of heat generated by the arc on opening.

6.6.3. Any device provided for voltage grading to damp oscillations or, to prevent re-strike prior to the complete interruption of the circuit or to limit over voltage on closing, shall have a life expectancy comparable of that of the breaker as a whole.

6.6.4. Breakers shall be so designed that when operated within their specified rating, the temperature of each part will be limited to values consistent with a long life for the material used. The temperature rise shall not exceed that indicated in IEC-62271-100 under specified ambient conditions.

6.6.5. The gap between the open contacts shall be such that it can withstand at least the rated phase to ground voltage for eight hours at zero pressure above atmospheric level of SF6 gas due to its leakage. The breaker should be able to withstand all dielectric stresses imposed on it in open condition at lockout pressure continuously (i.e. 2 p.u. power frequency voltage across the breaker continuously)

6.6.6. In the interrupter assembly there shall be an adsorbing 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 to be fully compatible with SF6 gas decomposition products.

6.6.7. Provisions shall be made for attaching an operational analyzer to record travel, speed and making measurement of operating timings etc. after installation at site. The contractor shall supply three set of transducer for each substation covered under the scope.

6.6.8. Circuit Breaker shall be supplied with auxiliary switch having additional 8 NO (normally open) and 8 NC (normally closed) contacts for future use over and above those required for switchgear interlocking and other control and protection function. These spare NO and NC contacts shall be wired upto the local control cubicle.

6.6.9. The CO (Close-open) operation and its timing shall be such as to ensure complete

travel/insertion of the contact during closing operation and then follow the opening operation.

6.7. **Operating mechanism**

6.7.1. General Requirements :

a) Circuit breaker shall be operated by spring charged mechanism or electro hydraulic mechanism or a combination of these. The mechanism shall be housed in a dust proof cabinet and shall have IP: 42 degree of protection.
b) The operating mechanism **box** shall be strong, rigid, rebound free and shall be readily accessible for maintenance.
c) The operating mechanism shall be suitable for high speed reclosing and other duties specified. During reclosing the breaker contacts shall close fully and then open. The mechanism shall be anti-pumping and trip free (as per IEC definition) under every method of closing.
d) The mechanism shall be such that the failure of any auxiliary spring will not prevent tripping and will not cause unwanted trip or closing operation of the Circuit Breaker.

e) 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.
f) Working parts of the mechanism shall be of 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.
g) The contractor shall furnish detailed operation and maintenance manual of the mechanism along with the operation manual for the circuit breaker.

6.7.2. **Control**

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

b) Each breaker pole shall be provided with two (2) independent tripping circuits and trip coils which may be connected to a different set of protective relays.

c) 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 control cabinet.
d) The trip coil shall be suitable for trip circuit supervision during both open and close position of breaker.

e) Closing coil and associated circuits shall operate correctly at all values of voltage between 85% and 110% of the rated voltage. Shunt trip and associated circuits shall operate correctly under all operating conditions of the circuit breaker upto the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of rated voltage. If additional elements are introduced in the trip coil circuit their successful operation and reliability for similar applications on circuit breakers shall be clearly brought out in the additional information schedules. In the absence of adequate details the offer is likely to be rejected.
f) Density meter contacts and pressure switch contacts 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 shall be monitored for remote annunciations and operation lockout in case of dc failures.

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

6.7.3. **Spring operated Mechanism**

a) Spring operated mechanism shall be complete with motor as per manufacturer practice. 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 required preferably not more than 90 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 automatically be charged for the next operation and an indication of this shall be provided in the local control cabinet & SAS.
g) Provisions shall be made to prevent a closing operation of the breaker when the spring is in the partial charged condition.
h) Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is in the closed position.
i) 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.
j) The spring charging failure alarm shall be provided with a time delay relay having setting range from 0-3 minutes.
k) Separate MCBs shall be provided for each spring charging motor and the rating of MCBs shall be suitably selected to match the starting, running and stalling time.
l) An overload relay shall be provided for protection of the spring charging motor.

6.7.4. **Hydraulically Operated Mechanism :**

a) Hydraulically operated mechanism shall comprise of operating unit with power cylinder, control valves, high and low pressure reservoir, motor etc.
b) The hydraulic oil used shall be fully compatible for the temperature range to be encountered during operation.
c) The oil pressure switch controlling the oil pump and pressure in the high pressure reservoir shall have adequate no. of spare contacts, for continuous monitoring of low pressure, high pressure etc. at switchyard control room.
d) The mechanism shall be suitable for at-least two close open operations after failure of AC supply to the motor starting at pressure equal to the lowest pressure of auto reclose duty plus pressure drop for one close open operation.
e) The mechanism shall be capable of operating the circuit breaker correctly and performing the duty cycle specified under all conditions with the pressure of hydraulic operated fluid in the operating mechanism at the lowest permissible pressure before make up.
f) Trip lockout shall be provided to prevent operations of the circuit breaker below the

minimum specified hydraulic pressure. Alarm contacts for loss of Nitrogen shall also be provided.

g) All hydraulic joints shall have no oil leakage under the site conditions and joints shall be tested at factory against oil leakage.

6.8. **Controlled Switching Device(CSD):**

6.8.1. 400 kV Circuit Breaker shall be equipped with controlled switching device with consequent optimization of switching behavior, when used in:

1. Switching of transformer (400 kV side circuit breakers only)
2. Switching of shunt reactor

6.8.2. The CSD shall be provided in 400 kV Circuit breakers for controlling transformers and reactors (ie for breakers of switchable line reactor and in Main& Tie circuit breakers of Transformers, Transmission lines with non-switchable line reactors and Bus reactors). The requirement of CSD shall be explicitly specified in price schedule

6.8.3. Technical Requirement for Controlled switching device:

a) The CSD shall be designed to operate correctly and satisfactorily with the excursion of auxiliary A/C & DC voltages and frequency as specified in section - GTR.

b) The CSD shall meet the requirements of IEC-61000-4 16 class IV regarding HF disturbance test and fast transient test shall be as per IEC-61000 – 4-4 level IV and insulation test as per 60255 – 5.

c) The CSD shall have functions for switching ON & OFF the circuit breakers.

d) The CSD shall get command to operate the breakers manually or through auto re-close relay at random. The controller shall be able to analyze the current and voltage waves available through the signals from secondaries of CTs & CVTs for the purpose of calculation of optimum moment of the switching the circuit breaker and issue command to circuit breaker to operate.

e) The CSD shall have an adaptive control feature to consider the next operating time of the breaker in calculation of optimum time of issuing the switching command. In calculation of net operating time of the breaker the controller must consider all factors that may affect the operating time of the breaker such as, but not limited to, ambient temperature, control voltage variation, SF6 gas density variations etc. Schematic drawing for this purpose shall be provided by the contractor. The accuracy of the operating time estimation by the controller shall be better than + 0.5 ms.

f) The CSD shall have communication port to facilitate online communication of the control switching device with SCADA directly on 61850 or through gateway which shall be under present scope.

g) The CSD shall be PC compatible for the setting of various parameters and down loading of the settings and measured values date time of switching etc. Window based software for this purpose shall be supplied by the contractor to be used on the owner's PC.

h) The CSD shall be suitable for current input of 1 amp from the secondary of the CTs. and 110 V (Ph to Ph) from the CVTs. The controller shall withstand transient and dynamic state values of the current from the secondary of the CTs and CVTs.

i) The CSD shall have time setting resolution of 0.1 ms or better.

j) The CSD shall have sufficient number of output/input potential free contacts for connecting the monitoring equipment and annunciation system available in the control room. Necessary details shall be worked out during engineering the scheme.

k) The CSD shall also record and monitor the switching operations and make adjustments to the switching instants to optimize the switching behavior as necessary. It shall provide self-diagnostic facilities, signaling of alarms and enable downloading of data captured from the switching events.

l) The provision for bypassing the Controlled switching device shall be provided through

BCU and SCADA both so that whenever, the CSD is not healthy due to any reason (including auxiliary supply failure), uncontrolled trip/close command can be extended to the circuit Breaker. Alternatively, in case of any non-operation of the CSD after receiving a close/trip command after a pre-determined time delay, the CSD should automatically be bypassed so as to ensure that the trip and close commands are extended to the Trip/Close coils through subsequent command.

m) The CSD shall be provided with a communication port to facilitate online communication of the CSD with Substation automation system directly on IEC 61850 protocols. If the CSD does not meet the protocols of IEC 61850, suitable gateway shall be provided to enable the communication of CSD as per IEC 61850.

6.9. The technical parameters of circuit breakers are as per **Annexure –1**

6.10. **Tests**

6.10.1. **Type Tests**

i. In accordance with the requirements stipulated under Section GTR the circuit breaker along with its operating mechanism shall conform to the type tests as per IEC-62271-100.

ii. The type test report of Electromagnetic Compatibility Test (EMC) of CSD shall be submitted for approval

iii. Circuit breakers meant for controlled switching shall conform to requirements of IEC/TR-62271–302. The contractor shall submit test reports to demonstrate that the offered CB conforms to the requirements of performance verification tests and parameter definition tests as per IEC/TR 62271-302. The contractor shall also furnish the report for the re-ignition free arcing window for switching 3-phase shunt reactor as demonstrated in the shunt reactor switching test.

6.10.2. **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 shall also be performed.

i. 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 **control** voltage conditions. 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. shall be **arranged by the contractor at his** own cost. After completion of site pre-commissioning test, 03 nos. travel transducer shall be handed over to DTL.

ii. During testing of CB, dynamic contact resistance measurement (DCRM) shall be carried out for close-open (CO) operations with delay of 300ms between close and trip operations. Minimum 100A current shall be injected for DCRM test. Travel characteristics, injected current, trip/close coil current shall also be recorded along with DCRM test. This test shall also be performed at site for which the necessary operation analyzer along with necessary transducers, cables, console etc. shall be provided. The test for getting signature of the dynamic contact resistance measurement shall also be carried out at factory. The test result shall be treated as reference signature for condition monitoring in future.

iii. Routine tests on circuit breakers with controlled switching device as per IEC/TR 62271-302.

7. DISCONNECTORS (ISOLATORS)

Disconnectors shall be three-pole group operated or Single-pole individual operated (as per single line diagram of the substation) and shall be installed in the switchgear to provide electrical isolation. The disconnectors shall conform to IEC- 62271-102 and shall have the ratings as specified in BPS/ Project Section.

7.1. **Construction & Design**.

7.2.1. The disconnectors shall be operated by electric motor suitable for use on 220 Volt DC systems and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over current and short circuit.

7.2.2. Disconnectors shall be suitable to switch the bus charging currents during their opening and closing and shall confirm to all three test duties viz TD1,TD2 and TD3 as per Annexure –F of IEC: 62271- 102.They shall also be able to make and break rated bus transfer current at rated bus transfer voltage which appears during transfer between bus bars in accordance with Annexure –B of IEC: 62271-102. The contact shielding shall also be designed to prevent restrikes and high local stresses caused by transient recovery voltages when these currents are interrupted.

7.2.3. The disconnect switches shall be arranged in such a way that all the three phases operate simultaneously. All the parts of the operating mechanism shall be able to withstand starting torque of the motor mechanism without damage until the motor overload protection operates.

7.2.4. It shall be possible to operate the disconnect switches manually by cranks or hand wheels.

7.2.5. For motor-operated disconnect switches, the control should be electrically and/or mechanically uncoupled from the drive shaft when the switch is operated manually to prevent coincident power operation of the switch and the drive mechanism(s).

7.2.6. The operating mechanisms shall be complete with all necessary linkages, clamps, couplings, operating rods, support brackets and grounding devices. All the bearings shall be permanently lubricated or shall be of such a type that no lubrication or maintenance is required.

7.2.7. The opening and closing of the disconnectors shall be achieved by either local or remote control. The local operation shall be by means of a two-position control switch located in the Local Control Cabinet (LCC).

7.2.8. Remote control of the disconnectors from the control room/SAS shall be made by means of remote/ local transfer switch.

7.2.9. The disconnector operations shall be inter-locked electrically with the associated circuit breakers in such a way that the disconnector control is inoperative if the circuit breaker is closed.

7.2.10. Each disconnector shall be supplied with auxiliary switch having additional 8 NO (Normally Open) and 8 NC (Normally Closed) contacts for future use over and above those required for switchgear interlocking and automation purposes. These spare NO and NC contacts shall be wired up to the local control cabinet.

7.2.11. The signaling of the closed position of the disconnector shall not take place unless it is certain that the movable contacts will reach a position in which the rated normal current, peak withstand current and short-time withstand current can be carried safely.

7.2.12. The signaling of the open position of the disconnector shall not take place unless the movable contacts have reached such a position that the clearance between the contacts is at least 80 percent of the rated isolating distance.

7.2.13. The disconnectors and safety grounding switches shall have mechanical/electrical inter-locks to prevent closing of the grounding switches when isolator switches are in the closed position and to prevent closing of the disconnectors when the grounding switch is in the closed position. Integrally mounted lock when provided shall be equipped with a unique key for such three phase group. Master key is not permitted.

7.2.14. The local control of the Isolator and high-speed grounding switches from the Local Control Cabinet (LCC) should be achieved from the individual control switches with the remote/local transfer switch set to local.

7.2.15. All electrical sequence interlocks will apply in both remote and local control modes.

7.2.16. Each disconnector shall have a clearly identifiable local, positively driven mechanical position indicator, together with position indicator on the local control cubicle (LCC) and provisions for taking the signals to the control room. The details of the inscriptions and colouring for the indicator are given as under :

INSCRIPTION	**COLOUR**	
Open Position	OPEN	GREEN
Closed Position	CLOSED	RED

7.2.17. All the disconnecting switches shall have arrangement allowing easy visual inspection of the travel of the switch contacts in both open and close positions, from the outside of the enclosure.

7.2.18. The disconnecting switches shall be provided with rating plates and shall be easily accessible.

7.2.19. The mechanical endurance class shall be M2 as per IEC.

7.2.20. Mechanical position indication shall be provided locally at each disconnector and Electrical indication at each Local Control Cabinet (LCC) / SAS.

7.2.21. All auxiliary switches and auxiliary circuits shall be capable of carrying a current of at least 10 A DC continuously.

7.2.22. The auxiliary switches shall be capable of breaking at least 10 A in a 220 V DC circuit with a time constant of not less than 20 milliseconds.

7.2.23. The disconnecting switches shall be capable of being padlocked in both the open and closed positions with the operating motor automatically disengaged. The padlocking device shall be suitable for a standard size lock with a 10 mm shank. The padlock must be visible and directly lock the final output shaft of the operating mechanism. Integrally mounted lock when provided shall be equipped with a unique key for such three phase group. Master key is not permitted.

7.3. The technical parameters of disconnectors are as per **ANNEXURE-2**

8. SAFETY GROUNDING SWITCHES

8.1. Safety grounding switches shall be three-pole group operated or single-pole individual operated (as per single line diagram of the substation). It shall be operated by DC electric motor and shall be equipped with a manual operating mechanism for emergency use. The motor shall be protected against over-current and short circuit.

8.2. Each safety grounding switch shall be electrically interlocked with its associated disconnectors and circuit breaker such that it can only be closed if both the circuit breaker and disconnectors are in open position. Safety grounding switch shall also be mechanically key interlocked with its associated disconnectors.

8.3. Each safety grounding switch shall have clearly identifiable local positive driven mechanical indicator together with position indicator on the Local Control Cabinet (LCC) and provision for taking the signal to Control room.

8.4. The details of the inscription and coloring for the indicator are given as under :

	INSCRIPTION	COLOUR
Open Position	OPEN	GREEN
Closed Position	CLOSED	RED

8.5. Interlocks shall be provided so that manual operation of the switches or insertion of the manual operating device will disable the electrical control circuits.

8.6. Each ground switch shall be fitted with auxiliary switches having 6NO (Normally Open) and 6NC (Normally Closed) contacts for use by others over and above those required for local interlocking and position indication purposes.

8.7. Provision shall be made for padlocking / suitable locking arrangement for the ground switches in either the open or closed position.

8.8. All portions of the grounding switch and operating mechanism required for grounding shall be connected together utilizing flexible copper conductors having a minimum cross-sectional area of 100 sq. mm.

8.9. The main grounding connections on each grounding switch shall be rated to carry the full short circuit current for 1 sec. and shall be equipped with a silver-plated terminal connector suitable for steel strap of adequate rating for connection to the grounding grid.

8.10. The safety grounding switches shall conform to the requirements of IEC- 62271- 102 and shall have electrical endurance class: E0 & shall have mechanical endurance class M2 for 400 kV & M1 for 220/66/33 kV voltage level.

8.11. The grounding switch shall be provided with test provision (insulated link) to permit test voltage up to 10 kV and up to 200 A to be applied to the main conductor without removing SF6 gas from the enclosure and without disassembling the enclosure except for ground shunt leads.

8.12. Combined Disconnectors & Safety grounding switch arrangement shall also be acceptable.

8.13. Mechanical position indication shall be provided locally at each switch and Electrical indication at each Local Control Cabinet (LCC) / SAS.

9. HIGH SPEED MAKE PROOF GROUNDING SWITCHES:

9.1. Grounding switches located at the beginning of the line feeder bay modules shall be of the high speed, make proof type and will be used to discharge the respective charging currents, trapped charge in addition to their safety grounding function. These grounding switches shall be capable of interrupting the inductive and capacitive currents and to withstand the associated TRV. These shall confirm to class B and electrical endurance class E1 as per annexure – C of IEC : 62271-102

9.2. High Speed Grounding switches shall be provided with individual/three pole operating mechanism suitable for operation from DC.

9.3. The switches shall be fitted with a stored energy closing system to provide fault making capacity.

9.4. The short circuit making current rating of each ground switch shall be at least equal to its peak withstand current rating as specified. The switches shall have inductive/ capacitive current switching capacity as per IEC-62271-102.

9.5. Each high speed make proof grounding switch shall have clearly identifiable local positive driven mechanical indicator together with position indicator on the Local Control Cabinet (LCC) and provision for taking the signal to Control Room/SAS.

9.6. The details of the inscription and coloring for the indicator shall be as under:-

	INSCRIPTION	COLOUR
Open Position	OPEN	GREEN
Closed Position	CLOSED	RED

9.7. High speed ground switch operation should be possible locally from Local Control Cabinet (LCC)

9.8. These high speed grounding switches shall be electrically interlocked with their associated circuit breakers and disconnectors so that the grounding switches cannot be closed if disconnectors are closed. Interlocks shall be provided so that the insertion of the manual operating devices will disable the electrical control circuits.

9.9. Each high speed ground switch shall be fitted with auxiliary switches having 6NO (Normally Open) and 6 NC (Normally Closed) contacts for use by others, over and above these required for local interlocking and position indication. All contacts shall be wired to terminal blocks in the Local Control Cabinet. Provision shall be made for padlocking the ground switches in their open or closed position.

9.10. All portion of the grounding switches and operating mechanism required for connection to ground shall be connected together utilizing copper conductor having minimum cross-sectional area of 100 sq. mm.

9.11. The main grounding connection on each grounding switch shall be rated to carry the peak withstand current rating of the switch for 1 sec. and shall be equipped with a silver plated terminal connector suitable for steel strap of adequate design for connection to the grounding grid.

9.12. The high speed make proof grounding switches shall confirm to the requirements of IEC-62271-102.

9.13. The grounding switch shall be provided with test provision (insulated link) to permit test voltage up to 10 kV and up to 200 A to be applied to the main conductor without removing SF6 gas from the enclosure and without disassembling the enclosure except for ground shunt leads.

10. INSTRUMENT TRANSFORMERS

10.1. CURRENT TRANSFORMERS

The current transformers and accessories shall conform to IEC:61869 and other relevant standards except to the extent explicitly modified in the specification.

The particulars of the various cores may change within reasonable limits as per the requirements of protection relay supplier. The manufacturer is required to have these values confirmed from the purchaser before proceeding with design of the cores. The other characteristics of CTs shall be as given in TECHNICAL PARAMETER of Current Transformer.

10.1.1. **Ratios and Characteristics: The** CT core distribution for various voltage levels shall be asper Table 3A, 3B, 3C 3D & 3E. Further the numbers of cores, rating, ratios, accuracy class, etc. for the individual current transformers secondary cores shall be in accordance with above table attached at **Annexure-3.**

Where multi-ratio current transformers are required the various ratios shall be obtained by changing the effective number of turns on the secondary winding.

10.1.2. **Rating and Diagram Plates:** Rating and diagram plates shall be as specified in the IECspecification incorporating the year of manufacture. The rated current & extended current rating in case of current transformers and rated voltage, voltage factor & intermediate voltage in case of voltage transformers shall be clearly indicated on the name plate.

The diagram plates shall show the terminal markings and the relative physical arrangement of the current transformer cores with respect to the primary terminals (P1 & P2).

The position of each primary terminal in the current transformer SF6 gas section shall be clearly marked by two plates fixed to the enclosure at each end of the current transformer.

10.1.3. **Constructional Details**:

a) The current transformers incorporated into the GIS will be used for protective relaying and metering purposes and shall be of metal- enclosed type.

b) Each current transformer shall be equipped with a secondary terminal box with terminals for the secondary circuits, which are connected to the Local Control Cubicle. The star/ delta configuration and the inter connection to the line protection panels will be done at the CT terminal block located in the local control cubicle.

c) Current transformers guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

d) The rated extended currents for 420 kV class Current transformers shall be as given below:

I. The secondary winding shall be rated for 2A continuously.

II. For 400 kV systems CT, the rated extended primary current of the CT shall be 200% of rated primary on all except 2000/1A tap. At 2000/1A tap the rated extended primary current shall be 120%. At 2000/1A ratio, the CT shall be thermally rated for 200% for 15minutes and 120% continuous.

III. For 400 kV CT rated for 3000A, the rated extended primary current shall be 120% for 3000/1A tap and 180% for 2000/1A tap and 200% for lower tap ratios. The secondary windings shall be rated for 2A continuously.

e) For 245/72.5 /36 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 Section – Project.

f) For 420/245/72.5/36 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 5% to 120%(or specified rated extended current whichever is higher) of rated current in case of metering CTs and up to the accuracy limit factor/knee point voltage in case of relaying CTs.

For 0.2S accuracy shall be maintained between 1% to 120% of rated current.
CT burden shall not be less than 5VA to achieve required 0.2S accuracy class

g) For 420/245/72.5/36 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 LCC panel suitably wired up to the terminal blocks.

h) The wiring diagram, for the interconnections of the three single phase CTs shall be provided inside the Secondary terminal box.

i) The current transformers shall be suitable for high speed auto-reclosing.

j) Provisions shall be made for primary injection testing either within CT or outside.

k) All the current transformers shall have effective electromagnetic shields to protect against high frequency transients. Electromagnetic shields to be provided against high frequency

transients typically 1-30 MHz.

l) The bidder will take care for the compatibility of the CT vis-à-vis burden of relay and connecting leads, however for calculation purpose fault current may be taken as 63kA for 400kV, 50kA for 220kV & 31.5 kA for 66kV/33kV and secondary current may be calculated accordingly.

m) The output burden of cores shall be as **Annexure 3A, 3B, 3C, 3D**. However burden of each core shall be finalized during detailed engineering.

10.2. VOLTAGE TRANSFORMERS

The voltage transformers shall conform to IEC- 61869 and other relevantstandards except to the extent explicitly modified in the specification.

Voltage transformers shall be of the electromagnetic type with SF6 gas insulation. The earth end of the high voltage winding and the ends of the secondary winding shall be brought out in the terminal box.

10.2.1. **Ratios and Characteristics**: The rating, ratio, accuracy class, connection etc. for thevoltage transformers shall be in accordance with **Annexure-4 & Table 4A,4B,4C,4D**

10.2.2. **Rating and diagram plates** :Rating and diagram plate shall be provided complying withthe requirements of the IEC specification incorporating the year of manufacture and including turns ratio, voltage ratio, burden, connection diagram etc.

10.2.3. **Secondary Terminals, Earthing and Fuses**

The beginning and end of each secondary winding shall be wired to suitable terminals accommodated in a terminal box mounted directly on the voltage transformer section of the SF6 switchgear.

All terminals shall be stamped or otherwise marked to correspond with the marking on the diagram plate. Provision shall be made for earthing of the secondary windings inside the terminal box.

10.2.4. The transformer shall be able to sustain full line to line voltage without saturation of transformer. The accuracy class will be at maximum tap.

10.2.5. **Constructional Details of Voltage Transformers:**

a) The voltage transformers shall be located as a separate bay module and will be connected phase to ground and shall be used for protection, metering and synchronization.

b) The voltage transformers shall be of inductive type, nonresistant and shall be contained in their own-SF6 compartment, separated from other parts of installation. The voltage transformers shall be effectively shielded against high frequency electromagnetic transients. The supplier shall ensure that there is no risk of Ferro resonance due to the capacitance of the GIS.

c) The voltage transformers shall have three secondary windings.

d) Voltage transformers secondary shall be protected by Miniature Circuit breakers (MCBs) with monitoring contacts for all the windings. The secondary terminals of the VT's shall be terminated to preferably stud type non-disconnecting terminal blocks in the secondary boxes via the fuse.

e) The voltage transformer should be thermally and dielectrically safe when the secondary terminals are loaded with the guaranteed thermal burdens.

f) The accuracy of 0.2 on secondary III should be maintained throughout the entire burden range up to 50 VA on all the three windings without any adjustments during operation.

g) The diagram for the interconnection of the VTs shall be provided inside secondary terminal box.

h) It should be ensured that access to secondary terminals is without any danger of access to high voltage circuit.

10.3. **Tests:**

10.3.1. Current Transformer and Voltage Transformer should have been type tested and shall be subjected to routine tests in accordance with relevant IEC.

10.3.2. The test reports of type tests, as applicable, as per IEC-61869-2 for CT, and IEC-61869-3 for IVT and following additional tests shall be submitted for the Employer's review.

a) Current Transformers (CT): Transmitted over voltage test for 66kV and above voltage rating
b) Inductive Voltage Transformers (IVT): Transmitted over voltage test for 66kV and above voltage rating

11. SURGE ARRESTORS

11.1. The surge arrestors shall confirm in general to latest IEC –60099-4.

11.2. **Insulation co-ordination and selection of surge arrestor**: The contractor shall be fullyresponsible for complete insulation co-ordination of switchyard including GIS. Contractor shall carry out detailed studies and design calculations to evolve the required parameters locations, energy capability etc. of surge arrestors such that adequate protective margin is available between peak impulse, surge and power frequency discharge voltages and BIL of the protected requirement. The locations of surge arrestors shown in single line diagram is indicative only. If the contractor feels that at some more locations the surge arrestors are required to be provided the same should also be deemed included in the offer.

If distance between Surge Arrestor and transformer bushing terminal inclusive of head length is more than 60 m or 170 ft then one surge arrestor shall be with GIS System and another shall be with transformer.

The contractor shall perform all necessary studies and the report shall detail the limits of all equipment parameters which could affect the insulation co-ordination. The report shall also detail the characteristics of the surge arrestor and shall demonstrate that the selected arrestor's protective and withstand levels, discharge and coordinating currents and arrestor ratings and comply with the requirement of this specification.

The contractor shall also consider in the studies the open circuit breaker condition, fast transients generated by slow operation of disconnecting switches. The study report and design calculations shall be submitted for Owner's approval.

11.3. **Duty requirements of GIS Surge Arrestor**

11.3.1. The surge arrestor shall be SF6 gas insulated metal oxide and gapless type. The metal housing of the arrestor shall be connected to the metal enclosure of the GIS with flange, bolted and gasketed joint so that the arrestor housing is grounded through GIS enclosure.

11.3.2. Surge arrestor shall be disconnect-link type and be attached to the gas-insulated system in such a manner that they can be readily disconnected from the system while the system is being dielectrically tested.

11.3.3. The surge arrester shall be of heavy duty station class and gapless (Metal oxide) type without any series or shunt gaps.

11.3.4. The surge arresters shall be capable of discharging over-voltages occurring during switching of unloaded transformers, reactors and long lines.

11.3.5. Surge arresters for the 400 kV class arrester shall be capable of discharging energy equivalent to class 4 of IEC for a 400 kV system on two successive operation followed immediately by 50 HZ energisation with a sequential voltage profile as specified below:

705 kVp for 3 peaks

580 kVp for 0.1 Sec.
565 kVp for 1 Sec.
550 kVp for 10 Secs.

11.3.6. 245 kV, 72.5kV & 33kV class arrester shall be capable of discharging energy equivalent to class 3 of IEC for 245 kV, 72.5 kV & 36kV systems respectively on two successive operations.

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

11.3.8. The surge arresters are being provided to protect the followings whose insulation levels are indicated in the table given below:-

Equipment	**Lightning impulse(kVp) for 420 kVsystem**	**Swicthing surge(kVp) for 420 kV system**	**Lightning impulse(kVp) for 245 kVsystem**	**Lightning impulse(kVp) for 72.5 kVsystem**	**Lightning impulse(kVp) for 36 kVsystem**
Pr.Transformer	+/-1300	+/-1050	+/-950	+/-325	170
InstrInstrument Transformer	+/-1425	+/- 1050	+/- 1050	+/-325	170
Reactor	+/-1300	+/- 1050	+/- 1050		
CB/ Isolator Phase to Ground	+/-1425	+/- 1050	+/- 1050	+/-325	170
Across Open Contract	+/-1425 (+ 240)	+/- 900 (+345)	+/- 1200	+/-375	195

11.3.10. **Constructional Features**

The nonlinear blocks shall be of sintered/inferred metal oxide material. These shall be provided in such a way as to obtain robust construction, with excellent mechanical and electrical properties even after repeated operations.

The arrestor enclosure shall be vertically or horizontally mounted to suit the layout of the switchgear as suggested by the supplier and each arrestor shall be fitted with a Online continuous resistive leakage current monitoring system along discharge counter. The system shall be provided with an interface to integrate with the substation automation system.

The main grounding connection from the surge arrestor to the earth shall be provided by the contractor. The size of the connecting conductor shall be such that all the energy is dissipated to the ground without getting overheated.

11.4. **TESTS**

11.4.1. In accordance with the requirements stipulated, the surge arrestors shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with IEC document.

11.4.2. Each metal oxide block shall be tested for the guaranteed specific energy capability in addition to the routine/acceptance test as per IEC-60099.

11.4.3. Test on Surge Monitors: The Surge monitors shall also be connected in series with the test specimens during residual voltage and current impulse withstands tests to verify efficacy of the same. Additional routine/functional tests with one 100A and 10 kA current impulse, (8/20 micro sec.) shall also be performed on the surge monitor.

11.5. **Technical Parameters**: Technical parameters f surge arrestor is as per **ANNEXURE-5**.

12. OUTDOOR SF6/Air BUSHINGS :

Outdoor bushings, for the connection of conventional external conductors to the SF6 metal enclosed switchgear, shall be provided where specified and shall conform to the requirements given in GTR. The dimensional and clearance requirements for the metal enclosure will be the responsibility of the manufacturer and their dimensions must be coordinated with the switchgear.

Bushings shall generally be in accordance with the requirements of IEC -60137.

12.1 Insulation levels and Creepage distances: All bushings shall have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS.

The creepage distance over the external surface of outdoor bushings shall not be less than than 31mm/kV.

12.2 **Bushing types and fitting**: The details of bushing shall be as follows

SF6 to air Bushing shall be of Polymer / composite type and shall be robust and designed for adequate cantilever strength to meet the requirement of seismic condition, substation layout. The electrical and mechanical characteristics of bushings shall be in accordance with IEC: 60137. All details of the bushing shall be submitted for approval and design review.

Polymer / composite insulator shall be seamless sheath of a silicone rubber compound. The housing & weather sheds should have silicon content of minimum 30% by weight. It should protect the bushing against environmental influences, external pollution and humidity. The hollow silicone composite insulators shall comply with the requirements of the IEC publications IEC 61462 and the relevant parts of IEC 62217. The design of the composite insulators shall be tested and verified according to IEC 61462.

12.3 **Mechanical forces on bushing terminals:** Outdoor bushings must be capable ofwithstanding cantilever forces due to weight of bus duct (GIB) on one side & AIS conductor/Al tube on the other side and short circuit forces.

12.4 Type test reports as per applicable IEC including radio interference voltage (RIV) test shall be submitted in line with the requirement as specified in section GTR for approval. Design calculations in support of the cantilever strength chosen shall be submitted for owners review and approval.

12.5 The technical parameters of Bushing are as per **ANNEXURE-6**.

13. GIS TO CABLE TERMINATION (If applicable)

13.1. This scope covers the supply, erection, commissioning of connection assembly of fluid-filled or extruded cables to gas-insulated metal enclosed switchgear (GIS) as per IEC 62271-209

13.2. The XLPE cables shall be connected to GIS by the interfacing of XLPE cable sealing end to GIS Cable termination enclosure.

13.3. The GIS to XLPE cable termination shall conform to IEC-62271-209.

13.4. The rating of XLPE cables for different voltages is specified in the Section project.

13.5. The limits of supply of gas-insulated metal-enclosed switchgear and the cable termination shall be in accordance with IEC 62271-209.

13.6 Cable termination and cable connection enclosure shall be suitable for the requirements for which it is designed. This interface section shall be designed in a manner which will allow ease of operation and maintenance.

13.7 The SF6 cable end unit and connection support structure should be equipped with provisions for isolating the cable sheath or pipe to permit cathodic protection of cable system.(see IEC62271-209)

13.8 The provision shall be made for a removable link. The gap created when the link is removed should have sufficient electric strength to withstand the switchgear high voltage site tests. The

contractor may suggest alternative arrangements to meet these requirements. The corona rings/stress shields for the control of electrical field in the vicinity of the isolation gap shall be provided by the GIS manufacturer.

13.9 All supporting structures for the SF6 bus-duct connections between the XLPE cable sealing ends and the GIS shall be the scope of the contract. The supplier may specify alternative connecting & supporting arrangements for approval of the Employer.

13.10 The opening for access shall be provided in each phase terminal enclosures as necessary to permit removal of connectors to isolate the XLPE cables to allow carrying out the insulation tests. The general arrangement drawing of interconnecting bus-duct from GIS bay module to XLPE cable termination end shall also be submitted.

13.11 Type test reports of radio interference voltage (RIV) level shall be submitted for approval.

14. TRANSFORMER / REACTOR TERMINATION

14.1. TRANSFORMER / REACTOR Direct Connection with GIS (if applicable)

14.1.1. The limits of supply of gas-insulated metal-enclosed switchgear and the direct connection to oil filled transformer shall be in accordance with IEC 62271-211.

14.1.2. The transformer / reactor termination module enables a direct transition from the SF6 gas insulation to the bushing of an oil-insulated transformer / reactor. For this purpose, the transformer/reactor bushing must be oil-tight, gas-tight and pressure resistant. Any temperature related movement and irregular setting of the switchgear's or transformer's/reactor's foundations are absorbed by the expansion fitting.

14.1.3. Terminal connection arrangement to connect GIS duct to bushing and duct mounting arrangement details shall be submitted during detailed engineering for Employer's approval and for co-ordination with transformer and reactor supplier. Any modification suggested by transformer and reactor supplier shall have to be carried out by the GIS supplier to facilitate proper connection with the bushings of the transformer and reactors.

14.2. TRANSFORMER / REACTOR Connection with SF6/Air Bushing

14.2.1. The oil filled transformers and reactors are as shown in the substation SLD. The oil to air bushings of the transformers and reactors shall be supplied by the respective Transformer/Reactor supplier and the same shall be connected to the SF6 ducts thru air to SF6 bushings to be provided under present scope.

14.2.2. In case of single phase Transformers/Reactors are being installed in the substation, HV&IV auxiliary bus for the Transformer/Reactor bank for connecting spare unit shall be formed inside the GIS hall as per the SLD furnished and as specified in Section project.

15. LOCAL CONTROL CUBICLE (LCC)

15.1. Functions

15.1.1. Each circuit-breaker bay shall be provided with a local control cubicle containing local control switches and a mimic diagram for the operation and semaphore/indicating lamp for status indication of the circuit-breaker and all associated isolators and earth switches together with selector switches to prevent local and remote and supervisory controls being in operation simultaneously.

15.1.2. Status indications in the LCC shall be semaphore type or LED type.

15.1.3. Closing of the circuit- breaker from the local control unit shall only be available when the breaker is isolated for maintenance purposes. Circuit-breaker control position selector, operating control switch and electrical emergency trip push button shall be installed in the Local Control Cubicle. Circuit-breaker control from this position will be used under maintenance and emergency conditions only. The emergency trip push buttons shall be properly shrouded.

15.1.4. If Disconnector or earth switch is not in the fully open or closed position a "Control Circuit Faulty" alarm shall be initiated, and electrical operation shall be blocked.

15.1.5. 20% spare terminals shall be provided in each LCC apart from terminals provided for the termination and interconnection of all cabling associated with remote and supervisory control,

alarms, indications, protection and main power supply etc .

15.1.6. Where plugs and sockets connect control cabling between the local control cubicle and the switchgear these shall not be interchanged. In plug in connector type cable arrangement, min 2 cores of the cable with connected condition on both side up to the TB to be left unused as spare.

15.1.7. Hydraulic/pneumatic and SF6 auxiliary equipment necessary for the correct functioning of the circuit breaker, isolators and earth switches shall be located in a separate cubicle compartment.

15.1.8. LCC shall be suitable for remote operation from substation automation system (SAS). Each gas tight compartment shall be monitored individually per phase basis through SAS.

15.2. **Constructional features**

15.2.1. Local Control cubicle shall be either mounted on the GIS with front access or free standing, floor mounting type. It 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. Alternatively folded sheet panels of adequate thickness and strength is also acceptable.

15.2.2. Access to all compartments shall be provided by doors. All fastenings shall be integral with the panel or door and provision made for locking. Cubicles shall be well ventilated through vermin-proof louvers(if required) having anti insect screen. All doors shall be gasketed all around with suitably profiled Neoprene/EPDM/PU gaskets conforming to the provision of IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors.

15.2.3. For LCC panel of each feeder bay (i.e. line, transformer, and reactor etc.), Bus Coupler bay and Bus Sectionalizer bay, separate AC/DC supply for power circuit of GIS switchgear shall be provided, fed directly from ACDB/DCDB. The control DC supply (for control, interlocking, signaling) shall be tapped from respective relay & protection panel. For LCC panel illumination and heating purpose Loop in Loop out AC Supply can be provided.

15.2.4. 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/MCBs. 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'.

15.2.5. Each LCC Panel shall be provided with the following

1. **Plug Point**: 240V, Single phase 50Hz, AC socket with switch suitable to accept 5/15Amps pin round standard Indian plug, shall be provided in the interior of each cubicle with ON-OFF switch.
2. **Interior Lighting**: Each panel shall be provided with a door-operated LED lightingfixture rated for 240 Volts, single phase, 50 Hz supply for the interior illumination of the panel controlled by the respective panel door switch.
3. **Space Heater**: Each panel shall be provided with a thermostatically connected spaceheater 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.

15.2.6 Operating mechanisms, auxiliary switches and associated relays, control switches, control cable terminations, and other ancillary equipment shall be accommodated in sheet steel vermin proof cubicles.

15.2.7 Local control cubicles shall be provided to be free standing and shall be equipped with anti-condensation heaters. A suitable humidity stat and thermostat shall be included in the heater circuit.

15.2.8 The interior of each cubicle shall be finished with a semi gloss white surface. An interior lamp suitable for the local LVAC supply, controlled by a door-operating switch, shall be fitted at the top of each panel.

15.2.9 The arrangement of equipment within cubicles shall be such that access for maintenance or removal of any item shall be possible with the minimum disturbance of associated apparatus. All the control switches shall be internal i.e. installed behind a lockable glass door, that allows a complete view of the annunciator and mimic diagram when the LCC door is closed. Necessary protection shall be provided to avoid inadvertent operation of control switches.

15.2.10 An interlocking scheme shall be provided that takes into account the following basic requirements.

I. To safeguard maintenance personnel who may be working on one section of the equipment with other sections live.

II. prevent incorrect switching sequences that could lead to a hazardous situation to plant, equipment and personnel.

15.2.11 Electrical bolt interlocks shall be energized only when the operating handle of the mechanism is brought to the working position. Visible indication shall be provided to show whether the mechanism is locked or free. Means, normally padlocked/handle lock, shall be provided whereby the bolt can be operated in the emergency of a failure of interlock supplies.

15..2.12 Where key interlocking is employed tripping of the circuit breaker shall not occur if any attempt is made to remove the trapped key from the mechanism. Any local emergency-tripping device shall be kept separate and distinct from the key interlocking.

15.2.13 Disconnecting switches shall be so interlocked that they cannot be operated unless the associated circuit-breaker is open except that where double bus bar arrangements are specified, on-load transfer of feeder circuits from one bus bar to another shall be made possible by interlocks which ensure that the associated bus coupler and its isolators are closed.

15.2.14 Bus coupler circuit breaker shall be interlocked so that it shall not be possible to open a bus coupler circuit breaker while on load change over on that side of the breaker is in progress.-

15.2.15 All isolating devices shall be interlocked with associated circuit-breakers and isolators in the same station so that it shall not be possible to make or break current on an isolating device unless a parallel circuit in that station is already closed.

15.3. **Cabling between LCC Panel and GIS equipment**

15.3.1. The unarmored screen cable shall be of 1.1kV grade, multi core, annealed copper conductor, Tinned copper braided screen (approx. 85% coverage).

15.3.2. The core insulation and outer sheath of cable shall be of halogen-free special polymer.

15.3.3. The cable shall be flame-retardant, flexible, abrasion-and wear-resistant.

15.3.4. The size of core shall not be less than 2.5 sq. mm for instrument transformers and 1.5 sq. mm for other control cable.

15.3.5. Prefabricated cables with heavy duty multi-point plug-in connections on GIS end shall be provided.

15.3.6. All instrument transformer connections shall be hard wired to terminal block via ring type connection.

16. GIS BUILDING

16.1. The buildings shall house each voltage class Gas Insulated Switchgear (GIS) and other associated equipment inside each of the GIS buildings. GIS building(s) shall be constructed for the specified number of bays/diameters as per section project.

16.2. For finalizing the dimensions of GIS building the requirement of Turning radius to rotate the largest removable component for assembly/disassembly shall be taken in to consideration.

16.3. Wherever GIS Building of already exists, then the existing GIS Building(s) for respective voltage class shall be suitably extended keeping the width of the building same to accommodate the number of bays/diameters as specified in the Section Project/BPS.

16.4. The contractor shall submit the design & construction proposal of the building along with necessary information, data, and drawings during the detailed engineering according to the complete requirements.

16.5. The area for GIS Building(s) is indicated in the BPS. The area given is for reference only and

may vary according to the requirement of the equipment to be installed inside. The contractor shall finalize the dimensions according to the equipment offered by them providing enough space & access for erection, operation and maintenance.

16.6. The contractor shall place their panels i.e. Bay level units, bay mimic, relay and protection panels, RTCC panels, Communication panels etc. in a separate Relay Panel Room in the GIS building. The size of the room shall be such that all the panels for the bays/ diameters as per clause 16.1 shall be accommodated in the above room. The panel room shall be air-conditioned. Further, the temperature of the room shall be monitored through substation automation system by providing necessary temperature transducers.

17. ELECTRIC OVERHEAD CRANE :

17.1. Two EOT Cranes of suitable capacity shall be provided for erection & maintenance of largest/heaviest GIS component/assembly for each of 400kV, 220kV, 66kV GIS hall/building. The crane shall consist of all special requirements for erection & maintenance of GIS equipment.

17.2. The capacity of the crane shall be sized to lift the heaviest GIS switchgear component.

17.3. The Crane shall be used for the erection and maintenance of the GIS switchgear components installed in the GIS switchgear room. On completion of erection of the switchgear, the Contractor shall completely service the crane before the Taking Over Certificate is issued.

17.4. Crane hook approaches shall be of the minimum possible dimensions to ensure maximum coverage of the GIS building area.

17.5. The crane(s) shall be capable of lifting and accurately positioning all loads ranging from full crane rated capacity to at least 10% rated capacity.

17.6. Crane shall be designed for operation under following variable speeds through VVVF drives at full load :

Hoisting: 0.3 – 3 Meters per Minute
Cross Travel: 1.6 – 16 Meters per Minute
Long Travel: 2.0 – 20 Meters per Minute

17.7. The electric overhead cranes shall be provided with walkways, platforms. shall be provided along the bridge rails and on the crab of EOT crane to facilitate cleaning/maintenance of the crane and to give access to the GIS room high bay lighting and ventilation duct and grilles.

17.8. The platform and walkways shall be designed to support any weight to be imposed upon them during crane overhaul.

17.9. An access platform shall be provided together with a guarded ladder to allow access to the bridge rails.

17.10. The crane shall be provided with pendant control and RF control.

17.11. Contractor shall submit the capacity calculation of crane for GIS hall considering a factor of safety of rope as at least 5.

17.12. The Capacity of Cranes to be provided for GIS Hall shall confirm following.

a) The crane for 400kV GIS hall shall have capacity of minimum 6T safe working load & minimum hook height of crane have shall be 9.0 meters or as per actual requirement whichever is higher.

b) The crane for 220kV GIS/66kV/33kV GIS shall have capacity of minimum 5T/3T safe working load & minimum hook height of crane have shall be 8.0/6.0 meters respectively or as per actual requirement whichever is higher.

17.13. In case the GIS hall is to be extended, the scope of work also involves extension of EOT crane girders and all necessary Electrical & Mechanical accessories to facilitate movement of existing EOT crane in the extended portion of GIS hall. Cost of the same shall be deemed to be covered in the building cost.

17.14. The following tests shall be carried out on EOT Crane.

1. The crane shall be tested at manufacturer work under full load and 25 percent overload of hoisting and cross transverse motions as a routine test.
2. Further the following tests may be done at site after installation of the crane at site

a. Check all the accessories for proper function
b. No load test
c. Load test as per site conditions

18. SEISMIC DESIGN CRITERIA:

The equipment shall be designed for operation in seismic zone for earthquake resistance. The seismic loads are due to the horizontal and vertical acceleration which may be assumed to act non concurrently. Seismic Qualification requirements shall be as per IEC 62271-207 for the design of equipment. The equipments along with its parts shall be strong enough and sufficiently well connected to resist total operating stresses resulting from the forces in normal operation but in case of abnormal condition shall also resist with forces superimposed due to earthquakes. The copies of type test reports for similar rated equipment, if tested earlier, should be furnished. If the equipment has not been type tested earlier Test Report/Analysis Report should be furnished during detailed engineering.

To prevent the movement of GIS sub assemblies i.e. various bay modules during the earthquake, suitable devices shall be provided for fixing the sub assemblies to the foundation. The contractor shall supply necessary bolts for embedding in the concrete foundation. The fixing of GIS sub assemblies to the foundation shall be designed to withstand the seismic events. It will also be ensured that the special devices as well as bolts shall not be over stressed. The details of the devices used and the calculations for establishing the adequacy shall be furnished by the supplier and shall be subject to the approval.

19. DESIGN REVIEW

19.1. Design reviews shall be conducted by Employer; however the entire responsibility of design shall be with the supplier.

19.2. Employer may also visit to the supplier's works to inspect design, manufacturing and test facilities.

19.3. The design review will commence after placement of award with the successful contractor and shall be finalized before commencement of manufacturing activity. These design reviews shall be carried out in detail to the specific design with reference of the GIS under the scope of this specification. Employer reserve the right to waive off the design review during detailed engineering.

19.4. The design review shall be conducted generally following the, "User Guide for the application of Gas Insulator Switchgear (GIS) rated voltage of 72.5kV and above" – CIGRE report No. 125 prepared by CIGRE Working Group 23.10.

19.5. The manufacturer will be required to demonstrate the use of adequate safety margins for thermal, mechanical, dielectric, insulation coordination and vibration etc. design to take into the account the uncertainties of his design and manufacturing processes.

19.6. The scope of such a design review shall at least include the following:

1. Dielectric Stress of Solid Insulation Like Gas barrier, Support insulator etrc.
2. Dielectric Stress of SF6 Gas Volume.
3. Mechanical strength of enclosure, expansion joints etc.
4. Criteria for providing expansion joint.
5. Sealing system

6. Insulation coordination
7. Thermal stress and resulting increase in gas pressure during short circuit condition.
8. Earthing of enclosure w.r.t circulating current.
9. Seismic design, as per IEC 62271-207
10. Circuit Breaker.
11. Isolator and Earth switch.
12. Voltage transformer.
13. Current Transformer.
14. Arrester.
15. Bushing.
16. Ducting.
17. Corrosion protection.
18. Electrical and physical Interfaces with substation.
19. Testing capabilities.
20. Inspection and test plan
21. Transport and storage.
22. Maintainability.
23. Site Test

19.7. Further, the manufacturer shall furnish the following information during detailed engineering:

a) Details regarding the loosely distributed metallic particles within the GIS encapsulation and calculations of critical field strength for specific particles of defined mass and geometry.
b) Study report of VFTO generated for GIS installation.
c) The methodology and all the equipment for electrical partial discharge (PD) detection, including that mentioned in the specification else-where.
d) The calculations and documents in support of the average intensity of electromagnetic field on the surface of the enclosure above during detailed engineering.
e) The detailed criteria/ design regarding location of pressure relief devices/rupture diaphragms
f) Calculations to show that there is no Ferro resonance due to capacitance of GIS for the voltage transformers
g) Design calculation for simulated parameters for Seismic level as applicable
h) Insulation Coordination studies including studies to recommend for additional surge arrestor
i) Calculations in support of touch & step voltages in all enclosures and earthing of complete GIS installation.
j) Measures to mitigate transient enclosure voltage by high frequency currents.
k) Calculation for providing bus duct supports.

20. TYPE TESTS

The offered GIS equipment shall conform to the type tests as per IEC-62271-203. Contractor shall submit type test reports for the following type tests & additional type tests.

Sl.	Description of the Type Test for GIS
1	Tests to verify the insulation level of the equipment and dielectric test on auxiliary circuits
2	Tests to prove the temperature rise of any part of the equipment and measurement of the resistance of the main circuit
3.	Tests to prove the ability of the main and earthing circuits to carry the ratedpeak and rated short time withstand current.
4	Tests to verify the making and breaking capacity of the included switching Devices.
5.	Tests to prove the satisfactory operation of the included switching devices.

6	Tests to prove the strength of the enclosures.
7	Gas tightness tests.
8	Tests on partitions.
9	Tests to prove the satisfactory operation at limit temperatures
10	Tests to assess the effects of arcing due to internal fault
11	Verification of the degree of protection of the enclosure
12	Tests to prove performance under thermal cycling and gas tightness tests on Insulators.
13	Additional tests on auxiliary and control circuits
14.	Reactor current switching test For Reactive Current switching capability as per Clause 6.4.1.
15.	Test to demonstrate the Power frequency withstand capability of breaker in open condition at lock out pressure
16	Electromagnetic compatibility tests (if applicable)
17	Radio inference voltage tests

The test reports of the above type tests for GIS (including type test report on Circuit breaker, Disconnect Switch, Grounding switches, Current and Voltage transformers as per relevant IEC and type tests of SF6/Air & Oil bushing as per IEC 60137 shall be submitted for approval as per Section- GTR, Technical Specification.

21. MISCELLEANOUS

21.1. **Painting of enclosure**: All enclosures shall be painted externally as per manufacturer'spainting procedure.

21.2. **Heaters:** Wherever required, heaters shall be provided to prevent moisture condensationinside various Marshaling boxes.

21.3. **Identification & rating plate**

Each bay shall have a nameplate showing

a) Each module will have its own Identification & rating plate. The rating plate marking for each individual equipment like Circuit breaker, Disconnect Switch Grounding switches, Current transformer, Voltage transformers, Surge arrester etc shall be as per their relevant IEC.
b) A schematic diagram indicating their relative locations.
c) DTL Contract no.

22. TRANSPORT OF EQUIPMENT TO SITE

The contractor shall be responsible for the loading, transport, handling and offloading of all equipment and materials from the place of manufacture or supply to site. The contractor shall be responsible to select and verify the route, mode of transportation and make all necessary arrangement with the appropriate authorities as well as determining any transport restrictions and regulations imposed by the government and other local authorities. All transport packages containing critical units viz Circuit breakers and Voltage transformers shall be provided with sufficient number of impact recorders (on returnable basis) during transportation to measure the magnitude and duration of the impact in all three directions. In case of electronic impact recorder, the recording shall commence in the factory and must continue till the units reach site. The data of electronic impact recorders shall be downloaded at site and a soft copy of it shall be handed over to Engineer – in –charge. Further, contractor shall communicate the interpretation of the data within three weeks.

23. PACKING, STORAGE AND UNPACKING

23.1. All the equipment shall be carefully packed for transport by sea, rail and road in such a manner that it is protected against the climatic conditions and the variations in such conditions that will be encountered enroute from the manufacturer's works to the site.

23.2. The SF6 metal clad equipment shall be shipped in the largest factory assembled units that the transport and loading limitations and handling facilities on site will allow to reduce the erection and installation work on site to a minimum.

23.3. Where possible all items of equipment or factory assembled units shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner. Should the units be considered too large for packing in crates, they shall be suitably lagged and protected to prevent damage to any part, particularly small projections, during transport and handling. Special lugs or protective supports shall be provided for lifting to prevent slings and other lifting equipment from causing damage. Each crate, container or shipping unit shall be marked clearly on the outside to show where the weight is bearing and the correct position for the slings.

23.4. Each individual piece to be shipped, whether crate, container or large unit, shall be marked with a notation of the part or parts contained therein.

23.5. Special precautions shall be taken to protect any parts containing electrical insulation against the ingress of moisture. This applies particularly to the metal clad equipment of which each gas section shall be sealed and pressurized prior to shipping. Either dry nitrogen/air or dry SF6 gas shall be used and the pressure shall be such as to ensure that, allowing for reasonable leakage, it will always be greater than the atmospheric pressure for all variations in ambient temperature and the atmospheric pressure encountered during shipment to site and calculating the pressure to which the sections shall be filled to ensure positive pressure at all times during shipment.

23.6. Blanking plates, caps, seals, etc., necessary for sealing the gas sections during shipment to site which may on later stage necessarily be used during repair and maintenance shall remain the property of DTL. Balance blanking plates, caps, seals, etc shall be returnable to the contractor. If considered necessary, blanking plates or other sealing devices shall be provided with facilities for measuring the gas pressure and recharging at any time during the transport period. Any seals, gaskets, 'O' rings, etc. that may be used as part of the arrangement for sealing off gas sections for shipment of site, shall not be used in the final installation of the equipment at site. Identification numbers shall be stamped into the blanking plates, etc., and on the switchgear equipment to which they are fitted so that they can easily be identified and refitted should it ever be necessary to ship sections of the switchgear back to the manufacturer's works for repair.

23.7. Valves and other gas couplings associated with the switchgear gas systems shall be adequately protected against damage from any bumps or physical blows. They shall also be capped to prevent ingress of dirt or moisture or damage to any coupling, pipes, threads or special fittings. Any explosion vents and other pressure relief devices shall be suitably sealed and protected to prevent accidental exposure of the sealed sections during shipment to site.

23.8. For bus ducts involving male and female joints of the current carrying conductor, the same shall be transported in disassembled condition to avoid any damage during transit. All bright parts liable to rust shall receive a coat of anti rusting composition and shall be suitably protected.

23.9. The contractor shall ensure that during the period between arrival at site and erection, all materials and parts of the contract works are suitably stored in such approved manner as to prevent damage by weather, corrosion, insects, vermin or fungal growth. The scope of providing the necessary protection, storing on raised platform, as required etc. is included in the works to be performed by the contractor. Cost of the raised platform for temporary storage is deemed to be included in overall cost. The raised platform needs to be made ready before arrival of GIS equipment at site. The contractor may use the available storage areas at site with permission of site in charge.

23.10. The equipment shall be unpacked immediately before Installation. They shall not be left lying unnecessarily in open crates or containers. Special precautions shall be taken when gas sections which have been sealed and pressurized for shipping are opened up to reduce the ingress of dirt and atmospheric moisture to a minimum. Whenever possible this shall only be done immediately prior to installation and if any section is to be left outside for any length of time after being opened, it shall be resealed and pressurized with either dry nitrogen or SF6

gas until required.

23.11. For the purpose of release of payment linked to receipt and physical verification in case of GIS equipment it shall mean random opening and physical verification of one number of packing unit of each type of main equipment (i.e. GIS CB/ISO/ES/PT/LA etc.) for each voltage level. Thereafter proper re-packing of the GIS unit shall be ensured as per manufacturer recommendation.

24. INSTALLATION OF GIS

24.1. Civil works of GIS Hall shall be completed in all respects before taking up the installation and it shall be ensured that Ventilation System is operational and all dust and dirt in the hall are removed. The GIS hall needs to be in positive pressure before starting Installation.

24.2. The installation area shall be secured against entry of unauthorized personnel. Only certified manufacturer's engineer and supervisor shall undertake the erection works. Engineers and supervisors of the manufacturer shall submit authorization and competency certificate to DTL.

24.3. Un-packaging of GIS modules shall be done outside the GIS hall and in no case module to be taken inside GIS hall with packing.

24.4. All assembly work shall be done by qualified personnel only who are to be identified and list submitted to DTL site before starting of erection work.

24.5. Assembly drawing for GIS erection for the section under progress shall be available and displayed in GIS hall at the time of erection work.

24.6. Working personnel shall clean their shoes or apply covers on shoes before entering the immediate working area. The working clothes of authorized personnel shall be made of non-fluffy material.

24.7. GIS hall door shall have automatic close facility after entry of personnel to avoid dust and moisture entry. Walls and ceiling shall be in a condition so that neither dirt nor plaster might fall or rub off and formation of condensation water in ceiling shall be prevented under any circumstances.

24.8. Floor in the installation area shall have a firm surface and shall be kept dust free with a vacuum cleaner. Vacuum cleaning to be done on regular basis.

24.9. Only T&P and consumables required for GIS erection shall be kept in GIS during erection.

24.10. In case of outdoor installation of GIS or of GIS components open gas compartments shall be protected from dust and moisture ingress (by tarpaulin covers/protective enclosure/chamber etc)

24.11. Bus duct exits in the GIS hall's wall shall be kept covered by suitable means until permanent cover is provided after installation of bus ducts.

24.12. Maintenance room (as a part of LCR room) shall be constructed for carrying out repair works/ small part assembly. All excess material (not required for immediate installation works) test equipment and tools and tackles to be stored separately from GIS hall in this room for rework.

24.13. Erection agency shall submit method statement and make available formats for checking during each stage of hall preparation, assembly process and final checks to be approved by DTL site before start of erection. Shock recorder down loaded data and analysis shall be submitted preferably before commencement of erection work. In case of violation of shock limits, expert form manufacturer shall visit and do the joint internal inspection and shall submit analysis report before giving clearance for erection. If required the module shall be taken back to factory for further analysis and testing.

24.14. Cleaning is of utmost importance and hence before assembly, all the loose metal parts, subassemblies and all contact & sealing surfaces shall be cleaned before installation. Cleaning shall be carried out with specified cleaning agents of the manufacturer, in no condition water is to be used except for external surfaces. Further, prior to opening of gas compartment, the same shall be thoroughly cleaned externally. The vacuum cleaning of the installation area shall also be done specially the immediate vicinity of the flanges to be connected.

24.15. All Civil Work inside building including internal cable trench shall be completed before GIS installation.

24.16. Installation of flanges shall be done immediately after removal of transport covers. Transport covers, O-rings and other packing material of GIS shall be taken out immediately after

removal.

24.17. O Rings shall be properly stored and taken out only before installation. O Rings are also to be cleaned before use with manufacturer authorized cleaning agent.

24.18. At all points of time during installation authorized personnel shall use suitable gloves to avoid contamination.

24.19. Cable termination work shall commence only after completion of GIS equipment erection, as during GIS installation period laying and termination of cables interferes with the GIS erection work and affects cleanliness.

24.20. Approved Field Quality Plan shall be followed during site work.

24.21. Proper power supply shall be ensured by installing DG Set of proper rating and frequency if required prior to commencement of erection work so that assembly work is not interrupted in the middle which is critical for GIS installation.

25. ON SITE TESTING

After the GIS Switchgear has been fully installed at site and SF6 gas filled at rated filling density, the complete assembly shall be subjected to the site tests as per IEC-62271-203 and with the test voltages specified below:-

25.1. Application of Power Frequency voltage test for duration of 1 minute with the value as per IEC 62271-203.

25.2. Directly after the above test at 25.1, Switching impulse test with three impulses of each polarity and with the value (80 % of the rated switching Impulse withstand level) as per IEC 62271-203.

25.3. In case of a disruptive discharge in the gas as outlined in clause no: C.6.2.2 Procedure b), Annexure-C of IEC 62271-203 during the AC voltage test and a repeat test is performed due to this failure, then the repeat test shall be carried out at Specified voltage.

25.4. In case of a disruptive discharge in the gas as outlined in clause no: C.6.2.2 Procedure b) Annexure-C of IEC 62271-203 during Oscillating Switching Impulse Test and a repeat test is performed due to this failure then the repeat test shall be carried out at a value equal to 90 % of the rated switching Impulse withstand level.

25.5. Method statement/ procedure of ON SITE high voltage testing, PD measurement and Switching Impulse test shall be submitted by contractor in advance. The adequacy of number of UHF sensors and their location shall be verified as per recommendations of CIGRE task force **TF 15/33.03.05** (Task force on **Partial dischargedetection system for GIS: Sensitivity verification for the UHF method and the acoustic method**). In case during site testing additional UHF sensors are required, the same shall also be supplied and installed to complete the technical requirement.

25.6. Application of AC voltage equal to 1.2 times the service voltage in order to condition the GIS whilst at the same time permitting measurement of Partial discharge and detection of conductive particles by UHF method.

25.7. In case of a disruptive discharge in the gas as outlined in clause no: C.6.2.2 Procedure b) annexure – C of IEC : 62271-203 , and a repeat test is performed due to failure during the AC voltage test , then the test shall be carried out at 1.2 times the service voltage .

25.8. The analysis of PD measured during High voltage test shall be done very carefully and presence of PD measured by any sensor shall be attended and HV test shall be repeated after the rectification work. Calibration of PD sensors shall be completed before start of HV test to establish reference for detection of PD above 5 pc.

25.9. Method statement/ procedure of onsite high voltage testing and PD measurement shall be submitted by contractor in advance.

26. VENTILATION SYSTEM FOR GIS HALL

26.1. Each GIS Hall shall have an independent ventilation system. Each Ventilation system shall consist of two 100% capacity systems, one operating and one stand-by.

26.2. To ensure that the air being supplied to the GIS hall is free from dust particles, a minimum two stage dust filtration process shall be supplied. This shall consist of at least the following:

i. Pre Filters: To remove dust particles down to 10 micron in size with at least 95% efficiency.

ii. Fine Filters: To remove dust particles down to 5 microns in size with at least 99% efficiency.

All the filters shall be panel type. Easy access should be available to the filters for replacement/cleaning.

26.3. The ventilation of the GIS hall shall be of a positive pressure type with minimum 4 air changes per hour. The pressure inside the GIS hall shall be maintained 5 mm of water above the atmospheric pressure. Fresh outdoor air shall be filtered before being blown into the GIS hall by the air fans to avoid dust accumulation on components present in the GIS hall. GIS hall shall be provided with motorized exhaust dampers with local control.

26.4. In case of extension of GIS hall is covered under the present contract, separate ventilation system shall be provided meeting the functional requirement as specified above and the same shall be integrated with existing ventilation system.

27. MANDATORY SPARE

Design, engineering, manufacture, testing, supply on FOR destination site basis including transportation & insurance, storage at site of Mandatory spares for the GIS(As specified in BPS).

28. TESTING & MAINTENACE EQUIPMENT

Testing & Maintenance equipment shall be offered, as per relevant schedule of BPS.

28.1. SF6 Gas leakage detector.

28.2. The technical specification of SF6 Gas leakage detector shall be as per **Annexure-8**

28.3. Gas filling and evacuating plant : (Gas Processing unit)

I. The plant necessary for filling and evacuating the SF6 gas in the switchgear shall be supplied to enable any maintenance work to be carried out. This shall include all the necessary gas cylinders for temporarily storing the evacuated SF6 gas. The capacity of the temporary storage facilities shall at least be sufficient for storing the maximum quantity of gas that could be removed from at least one phase of one complete bay (switchgear and associated equipment).

II. Where any item of the filling and evacuating plant is of such a weight that it cannot easily be carried by maintenance personnel, it shall be provided with lifting hooks for lifting and moving with the overhead cranes.

III. The minimum capacity parameters of evacuation plant will be as under :

Oil Free Suction (Recovery) Pump:	30 M^3/Hour
Compressor (Two Stage):	15 M^3/Hour
Oil Free Vacuum Pump:	100 M^3/Hour

IV. The evacuation equipment shall be provided with all the necessary pipes, couplings, flexible tubes and valves for coupling up to the switchgear for filling or evacuating all the gases.

V. Details of the filling and evacuating plant that will be supplied, as well as the description of the filling and evacuating procedures shall be furnished

28.3. SF6 gas analyzer: The technical specification of SF6 gas analyzer shall be as per(As per Annexure-9)

28.4. Portable Partial Discharge(PD) monitoring system (Shall generally applicable for

220kV,66kV& 33 kV)

I. The equipment shall be used for detecting different types of defects in Gas Insulated Stations (GIS) such as Particles, Loose shields and Partial Discharges as well as for detection of Partial discharges in other types of equipment such as Cable Joints, CTs and PTs.

II. It shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 100 MHz–2GHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principle of operation shall be based on UHF principle of detection. The instrument should also be able to detect partial discharges in cable joints and terminations.

III. Detection and measurement of PD and bouncing particles shall be displayed on built in large LCD display and the measurement shall be stored in the instrument and further downloadable to a PC for further analysis to locate actual source of PD such as free conducting particles, floating components, voids in spacers, particle on spacer surfaces etc. Software for display and diagnosis of PD signals and an expert software system for accurate interpretation of cause of PD shall also be supplied and installed by the contractor.

IV. The equipment shall meet the following requirements

1. Measurement shall be possible in noisy environment.
2. Stable reading shall be possible in presence of vibrations within complex GIS assemblies, which can produce signals similar to PD.
3. Equipment should have necessary synchronizing circuits to obtain PD correlation with power cycle and power frequency.
4. The equipment shall be battery operated with built-in-battery charger. It shall also be suitable for 230V AC/50 Hz input.
5. Measurement shall be possible in the charged switchyard in the presence of EMI/EMC. Supplier should have supplied similar detector for GIS application to other utilities. Performance certificate and the list of users shall be supplied along with the offer.
6. Instrument shall be supplied with standard accessories i.e., re-locatable sensors with mounting arrangements, connecting cables (duly screened) to sensors, Lap-top PC, diagnostic and expert interpretation software, carrying case, rechargeable battery pack with charger suitable for 230V AC, 50Hz supply connecting cables (duly screened) to view in storage.
7. The function of software shall be covering the following:
   a) Data recording, storage and retrieval in computer
   b) Data base analysis
   c) Template analysis for easy location of fault inside the GIS
   d) Evaluation of PD measurement i.e, Amplitude, Phase Synchronization etc.
   e) Evaluation of bouncing/loose particles with flight time and estimation on size of particle.
   f) Expert software system for accurate interpretation of cause of PD.
   g) Report generation.
8. To prove the suitability in charged switchyard condition, practical demonstration shall be conducted before acceptance.
9. Supplier shall have “Adequate after sales service” facility in India and shall provide the document in support of this.
10. Necessary training may be accorded to personnel to make use of the kit for locating PD sources inside the GIS
11. Instrument shall be robust and conform to relevant standard.

IV. **Calibration/Sensitivity verification:** The UHF Couplers have to be first calibrated as per

CIGRE Document No.654 as part of factory acceptance tests to guarantee detection sensitivity of 5pC or better. The GIS of same design shall be used as test specimen during the coupler calibration. The pulse injection level determined through above factory calibration tests shall only be used as reference for site sensitivity checks during commissioning of PDM system. The data sheet/frequency response characteristics shall be submitted for reference.

V. Pulse generator, same type as that of used during factory testing for UHF sensor sensitivity test shall be supplied as a standard accessory.

28.5. Online Partial Discharge Monitoring System (Applicable 400 kV GIS)

a) GIS equipment shall be designed so as to minimize partial discharge or other electrical discharge. A state-of-the art Partial Discharge Monitoring system shall be provided to monitor the entire GIS installation.

b) An on-line continuous Partial Discharge Monitoring (PDM) system shall be designed to provide an automatic facility for the simultaneous collection of PD data at multiple points on the GIS & its associated GIB ducts and Voltage Transformers adopting UHF technique. The data stored shall provide a historical record of the progress of PD sources and shall identify the areas of maximum activity.

c) On-line continuous Partial Discharge Monitoring (PDM) system shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 100 MHz–2GHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principle of operation shall be based on UHF principle of detection.

d) The scope shall cover Engineering, supply, installation, testing and commissioning of partial discharge continuous monitoring system, with all necessary auxiliaries and accessories to make a complete system as per technical specification, including site demonstration of successful operation. Any items/accessories necessary to make the system fully functional for the trouble free online PD monitoring of complete GIS installation shall be considered as included in the scope.
The PDM system shall be provided with all its hardware and software, with readily interfacing to the UHF PD couplers installed in the GIS of present bays and future bays as shown in SLD plus 20% additional as extra. Details of this shall be submitted during engineering stage for approval.
The integration of UHF PD coupler in future GIS bays shall be done in respective package. The number of UHF PD coupler for future bays shall be decided based on GIS layout finalized under present scope (considering present GIS equipment with future provision).
The PD Monitoring PC Work Station shall be housed in a lockable cabinet with duplicate keys and shall be located in the control room of the GIS substation. Workstation PCs shall be pre-loaded with all necessary Hardware & Software. The PCs shall have each Combo drive & Retrievable disk drive (1 TB), Ethernet port 100Mbps, printer. The workstation PC shall be powered by suitable dedicated UPS and same is included in the present scope.

e) Design of on-line PDM System

1. The technical proposal for PDM system along with detailed design documentation shall be submitted for EMPLOYER'S approval during engineering stage.
2. To guarantee that sufficient coverage is available for complete GIS installation to monitor PD activity all design details shall be submitted as part of the above for review.
3. The sensitivity of the offered system shall be in accordance with CIGRE Document No. 654 that will be verified as part of site sensitivity tests.
4. UHF attenuation data of GIS shall be submitted for the switching devices, spacers,

bends etc.

5. The signal attenuation level of co-axial cable per meter length and justification for the length of cable connection between the couplers and detector units shall be furnished.

6. The overall sensitivity of PD detection system shall take into account the spacing between couplers and the associated cabling, filters, amplifiers, etc.
7. The Sub-station GIS layout as a separate drawing indicating position of spacers, spread over of PD sensors with distance, sensor identification, the detector unit identification etc. shall be submitted during engineering stage for approval.
8. The PD sensors shall be identified / coordinated with the corresponding detector unit etc. with proper identification labeling and indicated in the substation PDM SLD.
9. Internal arrangement/wiring diagram is to be submitted for detector units/control cabinet etc. All internal items are to be identified / labeled to facilitate troubleshooting.
10. Supply requirement (AC & DC) to be specified for the complete monitoring system.
11. Power supply to PDM PC shall have protection against surges, overload and short circuit. A dedicated on-line UPS system shall also be provided as a backup during supply interruption, to ensure trouble-free & reliable running of the PDM System for a minimum of 15 minutes duration. Ratings of UPS shall be proposed for the approval of EMPLOYER'S. The UPS shall have enough capacity to initiate a 'safe' shut down of the PDM PC and the peripherals after this 15-minute period if normal supply fails to resume. The PDM PCs shall restart automatically on resumption of normal supply. The UPS shall not generate spikes during changeover of supply. UPS shall automatically give indication / alarm when it requires battery replacement. Potential Free Contacts shall be generated to signal these events. These contacts shall be wired out to Annunciation / Monitoring systems. Alternately, inverter of suitable capacity is also acceptable. Critical Process and Status alarms of the PDM system shall be displayed.
12. PDM System shall be provided with a user security for accessing the system with a log-on and password entry procedure. The user levels shall be defined as a Master User and other users for the modification of system, update, and entry of parameters or manual operation. System shall be able to generate 3D point on wave pattern whenever any PD activity detected by the system. System shall be able to give online 3D point on wave pattern, online PRPD (phase resolved PD) and online short time trend etc. System shall be able to generate the all the logs related to system fault, system access, PD event, and any changes in system setting etc.
13. Method of electrical isolation/protection provided between PD sensor and detector circuitry in case of flashover/high potential stress inside GIS should be furnished.
14. The selected mode of propagation of PD signal (electromagnetic wave) inside GIS for the design of sensors shall be furnished.
15. The protection available for electronics against transient over voltages caused by switching operations shall be furnished.

16. The capacity of each detector unit to be specified to accommodate as many numbers of PD sensors signal.
17. The applicable standards to meet IEC & IEEE requirements for electromagnetic compatibility shall be specified. The offered system should have been tested for the same for working in a 400kV & above substation environment. The necessary documentation has to be submitted in this regard.
18. Guaranteed technical particulars & data sheet for various components used in the system shall be submitted.

f) **Calibration:** The UHF Couplers have to be first calibrated as per CIGRE procedure TF15/330305 as part of factory acceptance tests to guarantee detection sensitivity of 5pC or better. The GIS of same design shall be used as test specimen during the coupler calibration.

The pulse injection level determined through above factory calibration tests shall only be used as reference for site sensitivity checks during commissioning of PDM system. The data sheet/frequency response characteristics shall be submitted for reference.

g) **Every Day Use &Maintenance** : The system shall be designed suitable for anunmanned s/s and operate automatically. The system shall generate alarms if suspected partial discharge activity is noticed or the system itself is in failure, thereby eliminating the necessity of periodic system access by the user and one such alarm shall be connected to Substation automation system (SAS). The alarms shall be configured coupler wise.

h) **Computers and Peripherals:** The PC operating system shall be the latest version of MSWindows. It should be suitable for continuous process application and should have been tested for the same. The hardware configuration of PC should be the latest available in the market of industrial type subject to EMPLOYER'S / Engineer approval. For storing the historical PD database, sufficient storage facility in the form of hard disc and retrievable hard disk drive of 1TB as specified shall be available in the substation. The PC monitor shall be 21" LCD type of reputed make.

i) **Filtering Facility:** The filtering facility has to be provided in order to distinguish real PDfrom internal/external noise such as switching operations, self-test signal, radio, communication signal etc. The PDM system itself shall be able to discriminate the noise from real PD. The exposed gas barriers of the GIS shall be shielded effectively against noise interference & tested. The gas barrier shields/belts shall be suitable for outdoor use also & able to withstand high ambient temperature. Site measurements have to be performed after installation of the PDM system in order to identify the various sources of external noise to incorporate the same in the filtering facility. This filtering will preferably be through software by band pass, which can be manually activated (as an option) to filter out noise signals in the trend plot display. If hardware filtering is employed then adequate measures have to be taken to avoid masking of other signals, which may lie in the same frequency range. The method adopted for the above shall be specified taking into account the sensitivity requirement of PDM system as per CIGRE document. The noise filters shall be selectable individually coupler-wise.

j) **Self-Test (Diagnostic) Facility**: Built-in self-checking facility shall be incorporated inthe control system which will continuously verify the correct operation of the whole monitoring system with the simulated PD signal viz. checking of the sensitivity of individual detector units, response of PD sensors in addition to the checking of the system functioning. The periodicity of such self-check operation shall be specified. In case of system failure this shall trigger an alarm for communication to SAS. External check facility: Propose the arrangement/device available for externally checking the healthiness of PD sensors by pulse injection in addition to built-in monitoring facility.

k) **Detector Units**: The sensitivity of each detector unit shall be furnished. The sensitivity levelof individual detector units shall be selectable depending on the site background noise level.

l) **Trend Plot**: The trend plot facility shall be available with the update period ofhourly/daily/weekly/monthly/yearly. It shall be possible to view the historical trends for the complete archived data accumulated over several years.

m) **PD Monitoring modes**: There shall be two different modes of system operation viz. adedicated Continuous PD Monitoring mode for the normal day today operation of the system & a dedicated HV commissioning test mode which is exclusively for PD monitoring during HV commissioning test. The HV commissioning mode shall also operate as an independent feature.

In the HV Commissioning mode the real time display shall be possible for a minimum of two complete bays with associated bus bars and at with one second update period. The HV test software shall automatically record the HV voltage information along with PD so as to check PD inception & extinction voltages precisely. The complete HV & PD data recorded during HV test shall be possible to be reviewed in replay mode after the HV test.

n) **Alarm Facility:** The PDM system shall generate alarm when action is required; viz. a)

PDalarm (abnormal PD activity indicating a risk of failure) & b) PD system fail alarm to be connected to SAS.

o) **Real Time Display:** The PDM system should have the facility of Real Time display, whichwill give an instant indication of PD activity coupler wise, with one-second-update period. The PDM system shall be able to capture the PD data triggered by associated switching operations of CBs & isolators.

p) **Schematics: The** PDM system should have GIS schemes bay-wise incorporating PD sensoridentification and location along with spacer location. The sectional view of typical bay arrangement of GIS showing active parts shall also be included as part of the PDM software.

q) **Print Option/Facility:** PDM system should have the option/facility of printing all trendplots/reports/POW patterns/displays, etc. Laser Colour printer shall be provided for this purpose at substation.

r) **Data Archives:** This is to provide access to historical data and file storage with date andtime stamp. Sufficient storage facility shall be available to review historical data updated for the lifetime of switchgear. The substation & headquarters PCs shall have a backup device in the form of a retrievable disk drive of 1TB capacity for this purpose.

s) **PD Fault Identification & Location/Pattern Recognition/Predictive Maintenance**
Diagnostic Software: In order to interpret various types of PD defects, intelligent diagnostics software (expert system) shall be built- in as part of the PDM software capability. This is mainly to reduce the dependence on PD specialist. The bidder shall also make available typical point-on-wave patters as library pictures to train the user.
Software Updates: It shall be possible to upgrade / update the system software throughout the lifetime of the system with the ongoing development / refinement in PD technology.

t) Fault investigation : In case of any indication of suspected PD activity by the on line system, further investigation has to be carried out by the contractor for the PD defect identification and location during the warranty period

u) Special Tools / equipment, Spare Parts, software packages
   i. Special Tools: Special tools for cutting and crimping of coaxial cable with 'N Connectors' shall be supplied.
   ii. Spare parts: The contractor has to supply critical spares with replacement procedure for the trouble free operation of the system during its expected lifetime as part of the contract. A detailed list shall be included in the tender and also submitted for EMPLOYER'S approval during the detailed engineering stage.
   iii. Software Packages: The complete software package shall be supplied as part of a back-up facility in the form of DVD/CDs viz. Windows operating system with end user license, PDM Software including HV Test, Drivers for modems etc., software for remote access, printer etc. The list shall be submitted for reference.
   iv. Pulse generator for UHF sensor sensitivity test shall also be supplied as a standard accessory.

v) Operation & Maintenance Manual :A complete O&M manual covering all aspects of trouble shooting of PDM system in six sets in original shall be provided & also in CD's. For diagram references colour pictures shall be provided. A step-by-step procedure for spare parts replacement shall also be included.

w) **Factory / Site Test Formats**: Thefactory& site tests format to be submitted for approval. Theformat shall cover all possible tests to confirm healthiness of the system and to record the test values.

x) List of References: The bidder shall provide a reference list of PD monitoring system, which is supplied by them and in successful operation worldwide in a power utility.

29.0 Training

The successful bidder shall arrange free of cost training to engineers of the purchaser/purchaser's representative in design, manufacture and testing of GIS being supplied for 120 man days.

- Four weeks on site and on-job training during erection.
- Two weeks training on GIS at principle manufacturer's works as per

curriculum specified below :

Curriculum for GIS Training

The curriculum of GIS training should at least cover the following aspects. Any other specificarea may be brought to notice and included.

1. General Explanation for GIS
2. Layout and Architecture of GIS
3. Gas Sectionalisation of GIS
4. Construction of CB
5. Operating Mechanism of CB
6. Maintenance of CB
7. Overhaul of CB (Interrupting chamber)
8. Overhaul of CB (Operating Unit)
9. Construction of DS/ES
10. Maintenance of DS/ES
11. Overhaul of DS/ ES
12. Construction of Bus/ Cable head/ SF6 – air bushing
13. Maintenance of Bus/ Cable head/ SF6 – air bushing
14. Overhaul of Bus/ Cable head
15. Overhaul of various transformer connections
16. Operation of GIS with SCADA
17. Construction & Maintenance of Lightning Arrester
18. Construction & Maintenance of VT/CT
19. Construction & Maintenance of Local control panel
20. Erection of GIS at site.
21. Installation & Testing of GIS at site
22. Type tests of GIS
23. Routine tests of GIS.
24. Faults simulation of GIS
25. Localization of GIS fault.

30. Service conditions

The equipment and the accessories to be supplied against this technical specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

1. Temperature: The reference ambient temperature be taken as 43.3 º C as per IS 9676.		
a.	Maximum ambient air temperature	50ºC
b.	Maximum daily average ambient temp	40^{o}C
c.	Maximum indoor ambient temp	35º C
2. Relative Humidity:		
a.	Maximum Relative Humidity	100%
b.	Minimum Relative Humidity	10%

3.	Average annual rainfall	750 mm
4.	Average no. of rainy day	50
5.	Average no. of thunderstorm days per annum	40
6.	Altitude	Not exceeding 300 meters
7.	Rain months	June to Oct.
8.	Wind pressure as per IS 875	195 Kg/Sq. meters up to 30 meters
9	Seismic Level	Zone-IV, as per IS-1893,Year-2002
10	Pollution class/creepage distance	31 mm/kV

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. Heavy lightening occurs in the area during rainy months (June to October).

All equipment shall be designed to withstand seismic forces, corresponding to an acceleration of 0.3 g horizontal.

ANNEXURE-1

Technical parameters of Circuit Breaker shall be as follows:

S.No.	Details	Unit	400kV	220kV	66kV	33kV
1.	Rated current	A	3000/2000 A (3000 for bus-coupler breaker& I/C bay)/ As per scheme	1600/2500 (2500 for bus-coupler breaker& I/C bay)/ As per scheme	2000/2500 (2500 for bus-coupler breaker& I/C bay)/As per scheme	1250/2500 (2500 for bus-coupler breaker & I/C bay)/As per scheme
2.	Operating mechanism		Spring/ hydraulic	Spring/ hydraulic	Spring/ hydraulic	Spring
3.	Rated fault current & its duration	kA	63 (1 sec.)	50 (1 sec.)	31.5 (1 sec.)	31.5 (1 sec.)
4.	Rated short circuit making current	kA	158	125	80	80
5.	Rated operating duty cycle:					
5a)	For auto-reclosing type		O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO	O-0.3 sec-CO-3 min-CO	NA
5b)	For non-auto reclosing type		------	------	------	CO-15sec-CO
6)	Lightning (Full wave)impulse withstand voltage (1.2/50 μ s)					
6a)	Between line terminals and ground	kVp	±1425	±1050	±325	±170
6b)	Between terminals with circuit breaker contacts open:	kVp	±1425 kVp impulse on one terminal & 240 kVp of opposite polarity on the other terminal	±1200	±375	±195
6c	-Lightning impulse voltage applied to one terminal	kVp	1425	---	---	---
6d	-Power frequency voltage applied to opposite terminal	kVp	240	---	----	----
7.	Switching impulse withstand voltage					

S.No.	Details	Unit	400kV	220kV	66kV	33kV
	(250/2500 s) dry & wet					
7a)	Between line terminals and ground	kVp	1050	---	---	---
7b)	Between terminals with circuit breaker contacts open:		900	--	---	---
7c	-Switching impulse voltage applied to one terminal	kVp	900	---	---	---
7d	-Power frequency voltage applied to opposite terminal	kVp	345			
8	One minute power frequency withstand voltage					
8a)	Between line terminals and ground	kV rms	As per IEC			
8b)	Between terminals with circuit breaker contacts open	kV rms	As per IEC			
9)	Minimum corona extinction voltage in open and close position	kV rms	320	156	105	---
10.	Maximum radio interference voltge for frequency between 0.5 to 2MHz in open and close position	Micro-volt	1000 (at 320 kVrms)	1000 (at 156 kVrms)	500 (at 92 kVrms)	---
11.	First pole to clear factor		1.3	1.3	1.3	---
12.	Maximum line charging current (rms)(5)	A	600	125	50	10
13.	Rated cable charging breaking current capacity (rms)	A	400	250	160	50
14.	Break time: -Total break time up to rated breaking current -Rated break time	ms	 45 40	 65 60	 65 60	 105 100
15.	Making time (closing time)	ms	<150	<200	<200	<200
16.	Difference in instants of closing/opening of contacts(6)					
	-within a pole	ms	2.5	2.5	--	--
	-Between poles (for opening)	ms	3.3	3.3	--	--
	-Between poles (for	ms	5	5	---	--

S.No.	Details	Unit	400kV	220kV	66kV	33kV
	closing)					
17.	Maximum noise level (7)	dB	140	140	140	140
18.	Maximum over –voltae on switching of transformer on no load	p.u.	<2.3	---	---	---
19.	Closing time	msec	100	100	100	100
20.	DC control voltage	V	220	220	220	220
21.	Auxiliary contacts continuous current rating	A	10	10	10	10
22.	Auxiliary contacts breaking capacity (for circuit time constant >20 ms)	A	2	2	2	2

Annexure-2

The major technical parameters of Disconnector and Earthing Switches for various voltage levels shall be as follows:

S.No.	Details	Unit	400kV System	220kV System	66kV System	33kV System
1.	Nominal/Rated voltage	kV	400	220	66	33
2.	Highest system voltage	kV	420	245	72.5	36
3.	Rated current	A	3150/2000 A (3000 for bus-coupler breaker& I/C bay)/ As per scheme	1600/2500 (2500 for bus-coupler breaker& I/C bay)/ As per scheme	2000/2500 (2500 for bus-coupler breaker& I/C bay)/As per scheme	1250/2500 (2500 for bus-coupler breaker & I/C bay)/As per scheme
4.	Rated fault current and its duration	kA	63 (1 sec)	50 (1 sec)	31.5 (1 sec)	31.5 (1 sec)
5.	Rated dynamic short circuit current	kAp	158	125	80	62.5
6.	Operating mechanism		AC motor operated & manual	AC motor operated & manual	AC motor operated & manual	Manual
7.	Lightning (Full wave) Impulse withstand voltage (1.2/50μs)					
7a)	Rated insulation Between line terminals and ground(+ve or –ve polarity	kVp	1425	1050	325	170
7b)	Between terminals with disconnector contacts open:	kVp	1425	1200	375	195
	-Lightning impulse voltage applied to one terminal	kVp	1425	--	--	--
	-Power frequency coltage of opposite polarity applied to other terminal	kVp	240	--	--	--
8.	Switching impulse withstand voltage (250/2500μs) dry & wet					
8a)	Between line terminals and ground	kVp	1050	--	--	--
8b)	Between terminals with circuit breaker contacts open:	kVp	900	--	--	--

	-Switching impulse voltage applied to one terminal	kVp	900			
	-Power frequency voltage of opposite polarity applied to other terminal	kVp	345			
9.	One minute power frequency withstand voltage:					
9a)	Between line terminals and ground	kVrms	650	460	275	70
9b)	Between terminals with disconnector contacts open	kVrms	815	530	315	80
10.	Operating time	Sec	<12	<12	<12	<12
12.	Maximum radio interference voltage for frequency between 0.5 to 2 MHz in open and close position	µ-volt	1000 (at 320 kVrms)	1000 (at 156 kV rms)	500 (at 92 kV rms)	--
13.	Total operating time	Sec	<12	<12	<12	<12
15.	DC control voltage	V	220	220	220	220
16.	Auxiliary contacts continuous current rating	A	10	10	10	10
17.	Auxiliary contacts breaking capacity (for circuit time constant >20ms	A	2	2	2	2

ANNEXURE-3

The major technical parameters of Current Transformer

S.No.	Details	Unit	400kV System	220kV System	66kV System	33kV System
1.	Nominal /Rated system voltage	kV	400	220	66	33
2.	Highest system voltage	kV	420	245	72.5	36
3	Rated fault current and duration	kA	63(1 sec)	50(1 sec)	31.5(1 sec)	31.5(1 sec)
4	Rated dynamic short circuit current	kA0	157.5	125	78.75	62.5
5	Lightning (Full wave)impulse withstand voltage (1.2/50µs) -between line terminals and ground	kVp	1425	1050	650	170
6	Switching impulse withstand voltage (250/2500µs) -between line terminals ground (dry& wet)	kVp	1050	--	--	--
7	One minute power frequency withstand voltage -between line terminals and ground	kVrms	630 (dry only)	460	275	75
8	One minute power frequency withstand voltage of secondary winding	kV	5	5	5	5
9	Minimum corona extinction voltage	kVrms	320	156	105	--
10	Maximum radio interference voltage for frequency between 0.5 to 2 MHz	µ-volt	1000 (at 320 kVrms)	1000 (at 156 kVrms)	500 (at 92 kVrms)	--
11	Maximum partial discharge level	pC	10	10	10	10
12	Cantilever	kg.	500	350	350	350

TABLE-3A

REQUIREMENTS FOR 420 kV CURRENT TRANSFORMER

No. of cores	Core No.	Applc ation	Current ratio	Output Burden (VA)	Accurcey Class as Per IEC: 61869	Min. Knee pt Voltage Vk	Max CT Sec. Wdg. Resista nce (ohm)	Max Excitation current at Vk in mA)
5	1	BUS DIFF CHEC K	3000-2000-1000/1	-	-	Vk>K.Is .(Rct +Rb)V	15/10/5	20 on3000/1tap. 30 on2000/1tap. 60 on1000/1tap.
	2	BUS DIFF MAIN	3000-2000-1000/1	-	-	Vk>K.Is .(Rct +Rb)V	15/10/5	20 on3000/1tap. 30 on2000/1tap. 60 on1000/1tap.
	3	MET E-RING	3000-2000-1000/1	20 20 20	0.2s 0.2s 0.2s	-	-	-
	4	TRA NS.B ACK UP/ LINE PRTN .	3000-2000-1000/1			Vk>K.Is .(Rct +Rb)V	15/10/5	20 on3000/1tap. 30 on2000/1tap. 60 on1000/1tap. .
	5	TRA NS. DIFF/ LINE PRTN .	3000-2000-1000/1			Vk>K.Is .(Rct +Rb)V	15/10/5	20 on3000/1tap. 30 on2000/1tap. 60 on1000/1tap. .

Note:

- The Bidder will ensure compatibility of CT and numerical relay in respect of knee-point voltage as well as operating time of relay to avoid mal-functioning or damage to the numerical relay.
- Protection cores shall be of accuracy class PX as per IEC 61869.
- Metering Core shall be of accuracy class 0.2S as per IEC: 61869

TABLE-3B
REQUIREMENTS FOR 245 kV CURRENT TRANSFORMER

No. of cores	Core No.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC: 44-1	Min. Knee pt Voltage Vk	Max CT Sec. Wdg.Resistance (ohm)	Max Excitation current at Vk in mA)
5	1	BUS DIFF CHECK	1600-800/1	-	-	1600/800	8/4	25on1600/1tap 50 on800/1 tap.
	2	BUS DIFF MAIN	1600-800/1	-	-	1600-800/1	8/4	25on1600/1ta 50 on800/1 tap.
	3	METE-RING	1600-800/1	20	0.2S	-	-	-
	4	TRANS. BACK UP/ LINE PRTN.	1600-800/1	-	-	1600-800/1	8/4	25on1600/1tap 50 on800/1 tap.
	5	TRANS. DIFF/ LINE PRTN.	1600-800/1	-	-	1600-800/1	8/4	25on1600/1tap 50 on800/1 tap.

NOTE:-

- 220kV C.T ratio of 1600-800/1-1-1-1-1 A for all bays
- The Bidder will ensure compatibility of CT and numerical relay in respect of knee-point voltage as well as operating time of relay to avoid mal-functioning or damage to the numerical relay.
- Protection cores shall be of accuracy class PX as per IEC 61869.
- Metering Core shall be of accuracy class 0.2S as per IEC: 61869

TABLE-3C
REQUIREMENTS FOR 72.5 kV CURRENT TRANSFORMER

No. of Cores	Core no.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC: 44-1	Min.Knee pt. Voltage Vk	Instrument security factor
4	1	METERING	*	20	0.2S	-	Less than 5
	2	Differential Protection	*	-	*	Vk>K.I.(Rc +R)V	
	3	Back-up Protection(O/C and E/F)	*	-	*	Vk>K.I.(Rc +R)V	
	4	REF Protection	*	-	*	Vk>K.I.(Rc +R)V	

*** NOTE:-**

i) Protection cores shall be of accuracy class PX as per IEC 61869.
Metering Core shall be of accuracy class 0.2S as per IEC: 61869

ii) 66kV C.T. of ratio 2000/1-1-1-1 A for incoming from 160 MVA Trf and 2000/1-1-1 for bus coupler (with core one for metering and core 2 for back-up protection)

iii) 66kV C.T. ratio 1000 /1-1-1 A for Feeder Protection with core 1 for metering, core 2 for Line protection and core 3 for back-up protection with above accuracy class.

TABLE-3D
REQUIREMENTS FOR 36kV CURRENT TRANSFORMER

No. of cores	Core no.	Application	Current ratio	Output Burden (VA)	Accuracy Class as Per IEC: 44-1	Min.Knee pt. Voltage Vk	Instrument security factor
3	1	METERING	*	10	0.2S	-	Less than 5
	2	PROTECTION/ O/C & E/F	*	-	*	Vk>K.I.(Rc+R)V	
	3	Back-up Protection	*	-	*	Vk>K.I.(Rc+R)V	

*** NOTE:-**

i) Protection cores shall be of accuracy class PX as per IEC 61869.
Metering Core shall be of accuracy class 0.2S as per IEC: 61869

ii) 33kV C.T. of ratio 2000/1-1-1 A for incoming from 100 MVA Trf. and for bus coupler.

iii) 33kV C.T. ratio 800-4001-1-1 A for feeder protection.

Annexure -4

The major technical parameters of voltage Transformer

S.No.	Details	Unit	400kV System	220kV System	66kV System	33kV System
1.	Nominal /Rated voltage	kV	400	220	66	33
2.	Highest system voltage	kV	420	245	72.5	36
3.	Fault current and duration	kA	63 (1 sec)	50 (1 sec)	31.5 (1 sec)	31.5 1 sec
4.	Rated primary voltage	kV	420/ √3	245/ √3	145/ √3	36/ √3
5.	Rated secondary voltage(1)	V	110/√3	110/√3	110/√3	110/√3
6.	Accuracy class					
	-protection		3P	3P	3P	3P
	-metering(2)		0.2	0.2	0.2	0.2
7,	Lightning (Full wave) impulse withstand voltage (1.2/50µs) -between line terminals and ground	kVp	1425	1050	650	170
8.	Switching impulse withstand voltage (250/2500 µs) - between line terminals and ground(dry & wet)	kVp	1050	--	--	--
9.	One minute power frequency withstand voltage -between line terminals and ground	kVrms	630 (dry only)	460	275	75
10.	Minimum corona extinction voltage	kVrms	320	156	105	--
11.	Maximum Radio interference voltage for frequency between 0.5 to 2 MHz	Micro-volt	1000 (at 320 kV rms)	1000 (at 156kV rms)	500 At 92 kVrms)	--
12.	Standard reference range of frequencies for which the accuracies are valid					
	-protection	%	96 to 102	96 to 102	96 to 102	NA
	-measurement	%	99 to 101	99 to 101	99 to 101	NA
13.	High frequency capacitance for	%	80 to 150% of rated	80 to 150% of rated	80 to 150% of rated	NA

S.No.	Details	Unit	400kV System	220kV System	66kV System	33kV System
	entire carrier frequency range		capacitance	capacitance	capacitance	
14.	Equivalent resistance over entire carrier frequency range	Ω	<40	<40	<40	--
15.	Stray capacitance and stray conductance of LV terminal over entire carrier frequency range		As per IEC 60358	As per IEC 60358	As per IEC 60358	--
16.	One minute power frequency withstand voltage (LV side)					
16a)	Between LV (HF) terminal and earth					
	-for exposed terminals	kVrms	10	10	10	10
	-for terminals enclosed in weather proof enclosure	kVrms	4	4	4	4
16b)	For secondary winding	kVrms	3	3	3	3
17.	Rated voltage factor					
	-continuous		1.2	1.2	1.2	1.2
	-for 30 seconds		1.5	1.5	1.5	1.5
18.	Maximum partial discharge level	pC	10	10	10	10
19.	Rated capacitance	pF	4400 (+10,-5%)	4400 (+10,-5%)	4400 (+10,-5%)	--
20.	Cantiliver strength	Kg	500	350	350	350

TABLE-4A
REQUIREMENT OF 400kV VOLTAGE TRANSFORMERS

Sl. No.	PARTICULARS	400kV		
1	Rated primary voltage	420/√3 kV		
2	Type	Electromagnetic, or Single phase capacitor VT		
3	No. of secondaries	3		
4	Rated voltage factor	1.2 continuous		
		1.5-30 seconds		
5	Phase angle error	±20 minutes		
		Sec.1	Sec II	Sec III
6	Rated voltage (V)	110/√3	110/√3	110/√3
7	Application	Protection	Protection	Metering
8	Accuracy	3P	3P	0.2
9	Output burden (VA) (minimum)	50	50	50

TABLE-4B
REQUIREMENT OF 220kV VOLTAGE TRANSFORMERS

S. N	PARTICULARS	220kV		
1	Rated primary voltage	245/√3 kV		
2	Type	Electromagnetic		
3	No. of secondaries	3		
4	Rated voltage factor	1.2 continuous		
		1.5-30 seconds		
5	Phase angle error	±20 minutes		
		Sec.1	Sec II	Sec III
6	Rated voltage (V)	110/√3	110/√3	110/√3
7	Application	Protection	Protection	Metering
8	Accuracy	3P	3P	0.2
9	Output burden (VA) (minimum)	50	50	50

TABLE-4C
REQUIREMENT OF 72.5kV VOLTAGE TRANSFORMERS

S. N.	PARTICULARS	66 kV		
1.	Rated primary voltage	72.5/√3 kV		
2.	Type	Electromagnetic		
3.	No. of secondary	3		
4.	Rated voltage factor	1.2 continuous		
		1.5-30 seconds		
5.	Phase angle error	±20 minutes		
		Sec I	Sec II	Sec III
6.	Rated voltage (V)	110/√3	110/√3	110/√3
7.	Application	Metering	Protection	Protection
8.	Accuracy	0.2	3P	3P
9.	Output burden (VA) (minimum)	50	50	50

TABLE-4D

REQUIREMENT OF 33kVVOLTAGE TRANSFORMERS

Sl. No.	PARTICULARS	33 kV		
1.	Rated primary voltage	36/√3 kV		
2.	Type	Electromagnetic		
3.	No. of secondaries	3		
4.	Rated voltage factor	1.2 continuous		
		1.5-30 seconds		
5.	Phase angle error	±20 minutes		
		Sec I	Sec II	Sec III
6.	Rated voltage (V)	110/√3	110/√3	110/√3
7.	Application	Metering	Protection	Protection
8.	Accuracy	0.2	3P	3P
9.	Output burden (VA) (minimum)	20	20	20

Annexure-5

The major technical parameters of Surge Arresters

S.No.	Details	Unit	400kV System	220kV System	66kV System	33kV System
1.	Rated SYSTEM voltage	kV	400	220	66	33
2.	Highest system voltage	kV	420	245	72.5	36
3.	Rated arrester voltage	kV	336	216	120	30
4.	Continuous operating voltage (COV) at 50˚C	kVrms	267	168	102	25
5.	Discharge current (8/20µs *wave*					
5a)	Nominal discharge current	kAp	20	10	10	10
5b)	Discharge current at which insulation c0ordination will be done	kAP	20	10	10	10
6.	Minimum discharge capability (1)	kJ/kV	12	5	5	5
7,	Maximum residual voltage for					
7a)	Lightning impulse current					
	-20kA	kVp	850	--	--	--
	-10kA	kVp	800	600	330	90
	-5kA	Micro-volt	--	560	310	85
7b)	Switching impulse current					
	-at 2kA	kVp	670	--	--	NA
	-at 1kA	kVp		500	280	NA
	-at 500A		650	--	--	NA
7c)	Steep current impulse at nominal discharge current		925	650	380	110
8.	Long duration discharge class (as per IEC)		Class 4	Class 3	Class 3	Class 3
9.	Perspective symmetrical fault current for pressure relief test (for 0.2 Sec)	kA(rms)	63	50	31.5	25
10.	Low current long duration test value		As per IEC (2400µs)	As per IEC (2400µs)	As per IEC (2400µs)	As per IEC (2400µs)

11.	High current impulse test value (4/10 micro sec.)	kAp	100	100	100	100
12.	Minimum corona extinction voltage	kVrms	320	156	105	NA
13.	Maximum radio interference voltage for frequency between 0.5 to 2 MHz	Micro-Volt	500 At 320 kV rms)	500 (at 156 kVrms)	500 (at 92 kVrms)	---
14.	Full wave impulse withstand voltage (1.2/50µs)-between line terminals and ground	kVp	1425	1050	650	170
15.	Switching impulse withstand voltage (250/250µs)-between line terminals and ground (Dry & wet)	kVp	1050	NA	NA	NA
16.	One minute power frequency withstand voltage between line terminals and	kV(rms)	630	460	275	70
17.	Maximum Partial Discharge for arrester at (1.05 x COV)	pC	50	50	50	50
18.	Cantilever strength	Kg	500	350	350	350

SYSTEM PARAMETERS **(Annexure -6)**

S.No.	Details	Unit	400kV system	220kV System	66kV system	33kV system
1.	Nominal/rated voltage	kVrms	400	220	66	33
2.	Highest system voltage	kVrms	420	245	72.5	36
3.	Phase	nos.	3	3	3	3
4.	Rated frequency	Hz	50	50	50	50
5.	Ambient temperature	^{o}C	50	50	50	50
6.	Specific creepage distance	mm/kV	31	31	31	31
7.	Rated fault current and its duration	kA	63 1 sec.	50 1 sec.	31.5 1 sec.	31.5 1 sec.
8.	Minimum corona extinction voltage	kVrms	320	156	105	NA
9.	Maximum radio interference voltage (RIV) for frequency between 0.5 & 2.0 MHz	-volt	1000 (at 320kV rms)`	1000 (at 156 kV rms)	500 (at 92 kV rms)	NA
10.	Seismic acceleration Zone-IV, as per IS-1893,Year-2002	G	0.3	0.3	0.3	0.3
11.	System neutral earthing		Effectively earthed	Effectively earthed	Effectively earthed	Effectively Earthed
12.	Auxiliary AC supply (3Ph,2wire,50 Hz)	V	415 ±10%			
13.	Auxiliary DC supply (2 wire ungrounded)	V	220 ±10%			

Annexure -7

TECHNICAL PARAMETERS FOR SF6/AIR BUSHING

Sl. No.	Particular	400 kV	220 kV	66kV	33kV
1	Rated Voltage (kV) (rms)	420 kV (rms)	245 kV (rms)	72.5 kV (rms)	36
2	Rated Current (Amp)	As per scheme	As per scheme	As per scheme	As per scheme
3	1.2/50 micro second impulse voltage (Lightning impulse withstand voltage)	1425 kVp	±1050 kVp	±325 kVp	±170 kVp
4	250/2500 micro second switching impulse voltage	1050 kVp	NA	NA	NA
5	One minute power frequency withstand voltage(kV R.M.S)	±650	±460	±140	±70
6	Minimum total Creepage distance in mm	31 mm/kV			
7	Minimum Cantilever strength (kN)	10	8	5	

Annexure-8

Technical Specifications for SF6 Gas Leak Detector Equipment along with Standard Accessories:

1. General Requirements

1.1 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version.

1.2 The instrument should have been proven for repeatability of test result in charged switchyard of EHV substations. Documentary evidence for this should be furnished along with the bid.

1.3 The acceptance of the equipment is subject to the successful demonstration to the satisfaction of DTL at prescribed site of DTL including 400KV switchyard/site during technical evaluation.

1.4 Under very high/low ambient temperatures, high humidity, equipment shall be able to carry out measurement under these conditions.

2. Functional Requirement:

2.1. The meter shall be capable of detecting leakage of SF6 from 400/220kV Circuit Breakers/GISequipments. Instrument shall work in induced condition of charged switchyard up to 400kV level. The equipment shall not be sensitive to moisture or other gases in atmosphere and water vapour.

2.2. It shall be Microprocessor controlled, with advanced digital signal processing, visual LED display Audible signal for progressive leak-size indication having following features:

a. easy and tactile keypad control, battery test function, battery low voltage indication etc;
b. Cordless and portable, Battery operated,
c. Immediate response time for quick leak detection and quick return to zero - position even after detection of large leaks.
d. The sensing probe shall be such that it can reach all the points on the switchgear where leakage is to be sensed.

2.3. The equipment and accessories shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation case and packing of the equipment shall be such that the transportation from one station to other will not affect the performance, repeatability and accuracy of measurement of equipment.

2.4. The test results should have repeatability consistency & immunity to electromagnetic, electrostatic interference in live switch yard up to 400kV.

2.5. Safety, EMC/EMI, Environment, Enclosure, and Interference limit shall be as per national/international standards with latest revision.

2.6. Accessories:

Set of batteries, Battery Charger, Manual, Hard Carrying case, Spare sensor tip etc, Software CD and other mandatory accessory.

SPARES: Filter Tips 5 nos, Infra red cell or any other consumable as required/Mandatory for operations of kit during guarantee period, Optional spares shall be quoted separately.

3. Technical Parameters:-

S.No.	Parameter	Specification
1.	Method of operation and principle	Continuous leak detection and leak measurement operation during leak check without limitation with audible and visual indication.(Infrared technology)
2.	Range of SF6 leak measurement during leak detection	0-1000 and more PPMv by volume with accuracy of ±5% or better
3.	Sensitivity	3.5 gm SF6/year or less. No cross sensitive to other gases
4.	Response Time	Immediately
5.	Alarm	Visual as well as Audio
6.	Power supply	Li-Ion batteries powered / equivalent power supply with charger.
7.	Batteries voltage indication/test function	To be displayed
8.	Spares	Mandatory for operation of equipment during guarantee period
9.	Operating Temperature & Relative Humidity	0 to 50°C& RH 95%

4. Calibration certificate:-

The instrument shall be supplied with proper Calibration certificate from NABL or internationally accredited lab. It is the responsibility of the supplier to provide the Calibration services of the instrument after the calibration interval is over. Date of Calibration Certificate shall not be older than three month from the date of supply of kit.

5. Demonstration:-

The bidder will have to demonstrate the equipment for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site up to the satisfaction of DTL at their own cost and ***this will be the part of technical evaluation***. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

6. Warranty/Guarantee Period:

Min 05 years from the date of successful & complete commissioning at DTL sub-station.

The warranty shall include:

a) Calibration of instrument (annually),

b) As much as visit for repairs to site, along with all the materials, including accessories etc. are to be covered under warranty/guaranty period. If the equipment needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of equipment for repair at test lab / works.

7. Services after sale:

Bidder will have to submit the documentary evidences of having established mechanism for prompt services as and when required by DTL. Bidder need to submit their organization service chart along with bid.

8. Commissioning, Training and Handling Over of the Instrument

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demo shall be rejected and no repairs are allowed.

Bidder will have to provide training to DTL engineers for safe operation and maintenance of the instrument before handing over the same at DTL site in batches."

9. Guaranteed technical particulars SF6 Gas Leak Detector Test Equipment along with Standard Accessories

Sr.No	Item	Description (To be filled in and signed by the Bidder)
1.	Mfg.Name/Model No.	
2.	Method of Operation and principle	
3.	Range of Sf6 leak measurement during leak detection	
4.	Sensitivity	
5.	Response Time	
6.	Alarm	
7.	Power Supply	
8.	Spares	
9.	Operating temperature	
10.	Accessories	
11.	Warranty	
12.	Calibration certificate	
13.	Services after Sale	
14.	Safety,EMC/EMI,Environment, Enclosure, and Interference applicable standards	

Annexure-9

Technical specifications of SF6 gas analyzer

1. General Requirements

1.1 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version.

1.2 The instrument should have been proven for repeatability of test result in charged switchyard of EHV substations. Documentary evidence for this should be furnished along with the bid.

1.3 The kit and accessories shall be robust and rugged enough, so that it can be transported safely to different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit. Further, the instrument shall be robust enough to sustain the jerks during the transportation in local condition.

1.4 Bidder will have to submit the documentary evidences of having established mechanism for prompt services in India as and when required by DTL. Bidder need to submit their organization service chart along with bid.

2. Functional Requirement

2.1. The instrument should be suitable for online measurement of Moisture (Dew point & ppm), Purity, SO2 content of SF6 Gas in gas insulated EHV equipments and GIS (Gas insulated switchgear), in live switchyard upto 400 kV level.

2.2. The measurement principle shall be based upon zero gas loss i.e. the gas will be returned back to original compartment of the GIS after performing the measurement without being exposed to the atmosphere.

2.3. The instrument shall be able to measure the pressure of the compartment under Test in bar, kPa, MPa.

2.4. The measurement should be possible at standard pressure/system pressure.

2.5. The test results should have repeatability consistency & immunity to electromagnetic, electrostatic interference in live switch yard up to 400kV.

2.6. It should have facility for Data Storing in the kit & down loading to PC. It should have USB / Ethernet Interface.

3. Technical Parameters:-

Item	Specification
Measurement Parameters	1. SF6 purity – Range: 0-100 % , Accuracy: +/- 0.5 % 2. Dew point - Range : -60 to +20 deg C, Accuracy: +/-4 deg C 3. SO2 - Range : 0-100 ppm, Accuracy : +/- 3 ppm 4. HF-Range :-10ppm & Accuracy : +/- 10 %
Input Pressure	0.5 to 9 Bar
Re-circulation/ Pumping Back of SF6 gas	The kit shall have the inbuilt facility of pumping back the measured SF6 gas to the equipment being tested.
Test Leads and accessories	Complete set of Hoses, pipes, coupling, valves etc. for measurement (min 10 m length) with suitable adaptors for connection with Equipment (Areva, CGL,ABB,Hyosung, BHEL, Siemens make GIS/CBs etc).
Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
Power Supply	150 – 240 V AC at 50 Hz and Inbuilt battery with charger/adapter etc.
Operating Temperature	-10 to +50 °C
Relative humidity	Max. 90 % non-condensing
IP Class	It should be housed in a robust IP67 case with wheels
Display/Control	LCD/Keypads.
Environment	The test kit shall be compatible for EMI/EMC/safety environment requirement as per IEC.

4. Calibration certificate:-

As per requirement of ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.

Calibration certificate from NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than two month from the date of supply of kit.

5. Demonstration:-

The bidder will have to demonstrate the kit for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site upto the satisfaction of DTL at their own cost and ***this will be the part of technical evaluation***. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

6. Warranty/Guarantee Period:

Min 03 years from the date of successful & complete commissioning at DTL sub-station. All the materials, including accessories etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of kit for repair at test lab / works.

7. Commissioning, Training and Handling Over of the Instrument

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demo shall be rejected and no repairs are allowed.

Bidder will have to provide training to DTL engineers for safe operation and maintenance of the instrument before handing over the same at DTL site in batches."

8. <u>Guaranteed technical particulars SF6 Gas Quality Analyzer Test Kit along with Standard Accessories</u>

Sr. No.	Particulars	Filled by bidder
1.	Name & Country of Manufacturer	
2.	Type / Model No.	
3.	SF6 Purity Measurement method	
4.	Pumpback of SF6 gas back in to breaker after measurement	
5.	Measurement parameter as per IEC60480 & CIGRE B3.02.01	
6.	SF6 Purity range with accuracy	
7.	Dew Point measurement range with accuracy	
8.	SO2 measurement range with accuracy	
9.	User selectable Inbuilt standards a) IEC60480 b) IEC60376	
10.	Measurement Cycle Selection	
11.	Direct Input Gas pressure	
12.	Vacuum purging for hose pipes	
13.	Quantum of SF6 gas used for measurement	
14.	Data storage	
15.	Display	
16.	Power input	
17.	Battery operation	
18.	Casing Protection class	
19.	Weight	
20.	Accessories	
21.	Service life	

SECTION-3:

GENERAL TECHNICAL REQUIREMENTS

SECTION : 3

GENERAL TECHNICAL REQUIREMENTS (GTR)

1.0 FOREWORD

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

2.0 GENERAL REQUIREMENT

2.1 The bidders shall submit the technical requirements, data and information as per the technical data sheets provided in the Volume III of bid documents.

2.2 The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc., fully in conformity with the technical specification.

2.3 It is recognized that the Contractor may have standardized on the use of certain components, materials, processes or procedures different from those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser's. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the specific requisite schedule, will not be considered as valid deviation.

2.4 Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section- Lighting System

2.5 Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard/substation unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment provided, shall be inter-changeable with one another.

2.6 The contractor shall design the system maintaining all the statutory clearances for both indoor and outdoor equipments as per relevant standards and norms. Contractor shall also design the building with sufficient working space for ease of operation and maintenance activities.

3.0 STANDARDS

3.1 The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

3.2 The equipment to be furnished under this specification shall conform to latest issue with all amendments (as on the date of bid opening) of standard specified under Annexure-C of this section, unless specifically mentioned in the specification.

3.3 The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other.

3.4 The Contractor shall also note that list of standards presented in this specification is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC.

3.5 When the specific requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.6 Other internationally accepted standards which ensure equivalent or better performance than that specified in the standards specified under Annexure-C / individual sections for various equipments shall also, be accepted, however the salient points of difference shall be clearly brought out in additional information schedule of Vol III along with English language version of such standard. The equipment conforming to standards other than specified under Annexure-C/ individual sections for various equipments shall be subject to Purchaser's approval.

3.7 The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

4.0 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

4.1 The equipment furnished under this specification shall perform all its functions and operate satisfactorily without showing undue strain, re-strike etc under such over voltage conditions.

4.2 All equipments shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.

4.3 All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

4.4 The bidder shall design terminal connectors of the equipment taking into account various forces that are required to withstand.

4.5 The equipment shall also comply to the following:
a) All outdoor EHV equipments except marshalling kiosks shall be suitable for hot line washing.
b) To facilitate erection of equipment, all items to be assembled at site shall be “match marked”.
c) All piping, if any between equipment control cabinet/ operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.

4.6 Operating times of circuit breakers and protective relays have been specified in respective sections. However, the bidder is allowed to have minor variations on the individual equipment timings subject to the condition that overall fault clearing time remains within 160 milli seconds at 220 kV level under comparable conditions.

4.7 EHV equipments and system shall be designed to meet the following major technical parameters as brought out hereunder.

4.7.1 System Parameter

S. No	Description of parameters	220 kV System	66kV System	33 kV System
1.	System operating voltage	220kV	66kV	33kV
2.	Rated frequency	50Hz	50Hz	50Hz
3.	No. of phase	3	3	3
4.	Rated Insulation levels			
	i) Full wave impulse withstand voltage (1.2/50μs)	1050 kVp	325kVp	170 kVp
	ii) One minute power frequency dry and wet withstand voltage (rms)	460kV	140kV	70kV
5.	Corona extinction voltage	156kV	-	-
6.	Max. radio Interference voltage for frequency b/w 0.5MHz and 2 MHz at 156kV rms for 220kV system	1000 μV	-	-
7.	Minimum creepage distance	25 mm/kV (6125 mm)	25 mm/kV (1812.5 mm)	25 mm/kV (900 mm)
8.	Min. clearances			
i)	Phase to phase	2100mm	630mm	320mm
ii)	Phase to earth	2100mm	630mm	320mm
iii)	Sectional clearances (These clearances are mentioned for air clearance)	5000 mm	3000mm	3000mm
9.	Rated short circuit current for 1 sec. duration	40 kA	31.5kA	31.5 kA
10.	System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed

Note : The insulation and RIV levels of the equipments shall be as per values given in the respective chapter of the equipments.
Bidder is required to maintain the clearances as per relevant IEC/IS and shall adhere to safety guidelines.

4.7.2 Major Technical Parameters

The major technical parameters of the equipments are given below. For other parameters and features respective technical sections should be referred.

(A)-I For 220/66/11 kV Power Transformer

Voltage ratio (kV)	**220/66/11**
Rated frequency (Hz)	50
Max. Design Ambient Temp. (°C)	50

Windings		HV	IV	LV
(i)	System Fault level (kA)	40	31.5	18.35
(ii)	1.2/50 micro sec. impulse withstand voltage kVp	±1050	±325	±170
(iii)	One minute power frequency voltage kV(rms)	±460	±140	±70
(iv)	Winding connection	Star	Star	delta
(v)	Neutral	- Solidly grounded -		
(vi)	Insulation	- Solidly grounded -		
(vii)	Vector Group	- YN yn0 d11 –		

(A)-II For 220/33/11 kV Power Transformer

Voltage ratio (kV)	**220/33/11**
Rated frequency (Hz)	50
Max. Design Ambient Temp. (°C)	50

Windings		220kV	33kV	11kV
(i) System Fault level (kA)		40	31.5	18.35
(ii) 1.2/50 µsec. impulse withstand voltage kVp		±1050	±170	±170
(iii) One minute power frequency voltage kV rms		±460	±70	±70
(iv)	Winding connection	Star	Star	delta
(v)	Neutral	- Solidly grounded -		
(vi)	Insulation	- Solidly grounded -		
(vii)	Vector Group	- YN yn0 d11 -		

(B) For 245 kV, 72.5kV & 36kV Circuit Breaker and Isolator

Rated voltage kV (rms)	**245**	**66**	**36**
Rated frequency (Hz)	50	50	50
No. of Poles	3	3	3
Design ambient temperature (°C)	50	50	50

Rated insulation levels :

1) Full wave impulse withstand voltage (1.2/50 µsec.)

- between line terminals and ground	± 1050 kVp	±325 kVp	±170 kVp
- between terminals with circuit breaker open	± 1200 kVp	±375 kVp	±195 kVp
- between terminals with isolator open	± 1200 kVp	±375 kVp	±195 kVp

2) One minute power frequency dry and wet withstand voltage

- between line terminals and ground	460 kV (rms)	±140 kVp	±70kV (rms)
- between terminals with circuit breaker open	530 kV (rms)	As per IEC	As per IEC
- between terminals with Isolator open	530 kV (rms)	As per IEC	As per IEC

3) Max. radio interference voltage (µV) for frequency between 0.5 MHz and 2 MHz in all positions of the equipments.	1000 (at 156 kV rms)	-	-
4) Minimum creepage distance :-			
Phase to ground (mm)	6125	1812.5	900
Between CB Terminals (mm)	6125	1812.5	900
5) System neutral earthing	Effectively earthed	Effectively earthed	Effectively earthed
6) Seismic acceleration	- 0.3g horizontal -		

7) Rating of Auxiliary Contacts	- 10 A at 220 V DC -
8) Breaking capacity of Auxiliary contacts	2 A DC with circuit time constant of not less than 20 ms.

Auxiliary Switch shall also comply with other clauses of this chapter.

(C) FOR 245 kV, 72.5kV & 36kV CT/CVT/SA

Rated voltage kV (rms)	**245**	**72.5**	**36**
Rated frequency (Hz)	50	50	50
No. of poles	1	1	1
Design ambient temperature (°C)	50	50	50

Rated insulation levels :

1) Full wave impulse withstand voltage (1.2/50 micro sec.)				
-	between line terminals and ground for CT and CVT	± 1050 kVp	±325 kVp	±170 kVp
-	for arrester housing	± 1050 kV peak	±325 kVp	±170 kVp
2) One minute power frequency dry and wet withstand voltage				
-	between line terminals and ground for CT and CVT	±460 kV rms	±140 kVp	±70 kV rms
-	for arrester housing	±460 kV rms	±140 kVp	± 70kV rms
3) Max. radio interference voltage (μV) for frequency between 0.5 MHz and 2 MHz in all positions of the equipment		1000 for CT/CVT 500 for SA (at 156 kV rms)		
4) Minimum creepage distance :-				
- Phase to ground (mm)		6125	1812.5	900
5) System neutral earthing		- Effectively earthed -		
6) Seismic acceleration		- 0.3g horizontal -		
7) Partial discharge for :-				
- Surge arrester at 1.05 COV		- Not exceeding 50 pc. -		
- for CT/CVT		- Not exceeding 10 pc. -		

(D) Technical Parameters of Bushings/Hollow Column insulators/support insulators:

	220 kV	**66kV**	**33 kV**
(a) Rated Voltage (kV)	245	72.5	36
(b) Impulse withstand voltage (Dry & Wet) (kVp)	±1050	±325	±170
(c) Power frequency withstand voltage (dry and wet) (kV rms)	±460	±140	±70
(d) Total creepage distance (mm)	6125	1812.5	900

(e) Pollution Class-III Heavy (as per IEC 71) and as specified Section-2 for all class of equipment

(f) Insulator shall also meet requirement of and IEC-815 for 220 kV system, as applicable having alternate long & short sheds.

5.0 ENGINEERING DATA AND DRAWINGS

5.1 The engineering data shall be furnished by the Contractor in accordance with the Schedule for each set of equipment as specified in the Technical Specifications.

5.2 The list of drawings/documents which are to be submitted to the Purchaser shall be discussed and finalised by the Purchaser at the time of award. The Contractor shall necessarily submit all the drawings/ documents unless anything is waived. The Contractor shall submit 4 (four) sets of drawings/ design documents /data/ test reports as may be required for the approval of the Purchaser.

5.3 Drawings

5.3.1 All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, dimensions, internal & the external connections, fixing arrangement required and any other information specifically requested in the specifications.

5.3.2 Each drawing submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

5.3.3 Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

5.4 The review of these data by the Purchaser will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. This review by the Purchaser may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the purchaser shall not be considered by the Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

5.5 All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

5.6 All engineering data submitted by the Contractor after final process including review and approval by the Purchaser shall form part of the Contract Document and the entire works performed under these specifications shall be performed I strict conformity, unless otherwise expressly requested by the Purchaser in Writing.

5.7 Approval Procedure

The scheduled dates for the submission of the drawings as well as for, any data/information to be furnished by the Purchaser would be discussed and finalised at the time of award. The following schedule shall be followed generally for approval and for providing final documentation.

i)	Approval/comments by Purchaser on initial submission	As per agreed schedule
ii)	Resubmission (whenever from date of Comments required including both ways postal time).	Within3 (three) weeks
iii)	Approval or comments	Within 3 weeks of receipt of resubmission.
iv)	Furnishing of distribution copies in bound volume (5 copies per substation and one copy for Corporate Centre)	2 weeks from the date of final approval
v)	Furnishing of distribution copies of test reports	
(a)	Type test reports (one copy per substation plus one copy for corporate centre)	2 weeks from the date of final approval
(b)	Routine Test Reports	-do

	(one copy for each substation)	
vi)	Furnishing of instruction/ operation manuals (4 copies per substation and two copies for corporate centre)	As per agreed schedule
vii)	RTFs of drawings (one set substation and one set for corporate centre)	-do
(viii)	Video Cassette (VHS-PAL) - highlighting installation and maintenance techniques/ requirements of circuit breaker & isolators (one per substation plus one for corporate centre)	-do
(ix)	As built drawings & RTFs (Two sets per substation plus one set for corporate centre)	On completion of entire works
(x)	ROM optical disks for all As built drawings (one per substation plus one for corporate	-do

NOTE:

(1) The contractor may please note that all resubmissions must incorporate all comments given in the earlier submission by the Purchaser or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

(2) The drawings which are required to be referred frequently during execution should be submitted on cloth lined paper. The list of such drawings shall be finalised with the Contractor at the time of Award.

(3) All major drawings should be submitted in Auto Cad Version 12 or better.

(4) The instruction Manuals shall contain full details of drawings of all equipment being supplied under this contract, their exploded diagrams with complete instructions for storage, handling, erection, commissioning, testing, operation, trouble shooting, servicing and overhauling procedures.

(5) If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Purchaser.

(6) The Contractor shall furnish to the Purchaser catalogues of spare parts.

5.8 The list of major drawings and General Technical Parameters shall be as per Annexure – D.

6.0 MATERIAL/ WORKMANSHIP

6.1 General Requirement

6.1.1 Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended.

6.1.2 Incase where the equipment, materials or components are indicated in the specification as “similar” to any special standard, the Purchaser shall decide upon the question of similarity. When required by the specification or when required by the Purchaser the Contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

6.1.3 The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual

agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads.

The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

6.1.4 Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

6.1.5 All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be considered as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances, instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacturer's limits suitable guards shall be provided for the protection of personnel on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purposes. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

6.1.6 The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

6.1.7 All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case he shall declare in the proposal, where such oil or grease is available. He shall help Purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

6.1.8 A cast iron or welded steel base plate shall be provided for all rotating equipment which are to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of design with pads for anchoring the units, shall have a raised up all around and shall have threaded in air connections, if so required.

6.1.9 Corona and radio interference voltage test and seismic withstand test procedures for equipments shall be in line with the procedure given at Annexure-A and B respectively.

6.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favourable to the growth of fungi and mildew. The indoor equipments located in non-air-conditioned areas shall also be of same type.

6.2.1 Space Heaters

6.2.1.1 The heaters shall be suitable for continuous operation at 240 V as supply voltage. On-off switch and fuse shall be provided.

6.2.1.2 One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

6.2.1.3 Suitable anti condensation heaters with the provision of thermostat shall be provided.

6.2.2 FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

6.2.3 Ventilation opening

Wherever ventilation is provided, the compartments shall have ventilation openings with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds and suitable provision shall be made so as to avoid any communication of air / dust with any part in the enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc.

6.2.4 Degree of Protection

The enclosures of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a) Installed out door: IP- 55
b) Installed indoor in air conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non air conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards) : IP-52
The degree of protection shall be in accordance with IS:13947 (Part-I)/ IEC-947 (Part-I)/ IS 12063 / IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

6.3 RATING PLATES, NAME PLATES AND LABELS

6.3.1 Each main and auxiliary item of substation is to have permanently attached to it in a conspicuous position a rating plate of non-corrosive material upon which is to be engraved manufacturer's name, year of manufacture, equipment name, type or serial number together with details of the loading conditions under which the item of substation in question has been designed to operate, and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirement.

6.3.2 All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators and C & R panels shall be bilingual with Hindi inscription first followed by English. Alternatively two separate plates one with Hindi and the other with English inscriptions may be provided.

6.4 FIRST FILL OF CONSUMABLES, OIL AND LUBRICANTS

All the first fill of consumables such as oils, lubricants, filling compounds, touch up paints, soldering/brazing material for all copper piping of circuit breakers and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications, into successful Operation, shall be furnished by the Contractor unless specifically excluded under the exclusions in these specifications and documents.

7.0 DESIGN IMPROVEMENTS / COORDINATION

7.1 The bidder shall note that the equipment offered by him in the bid only shall be accepted for supply. However, the Purchaser or the Contractor may propose changes in the specification of the equipment or quality thereof and if the Purchaser & contractor agree upon any such changes, the specification shall be modified accordingly.

7.2 If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.

7.3 The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, subassemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

7.4 The Contractor has to coordinate designs and terminations with the agencies (if any) who are Consultants/Contractor for the Purchaser. The names of agencies shall be intimated to the successful bidders.

7.5 The Contractor will be called upon to attend design co-ordination meetings with the Engineer, other Contractor's and the Consultants of the Purchaser (if any) during the period of Contract. The Contractor shall attend such meetings at his own cost at New Delhi or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

8.0 QUALITY ASSURANCE PROGRAMME

8.1 To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's Works or at his Sub-contractor's premises or at the Purchaser's site or at any other place of Work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be broadly outlined by the contractor and finalised after discussions before the award of contract. The detailed programme shall be submitted by the contractor after the award of contract and finally accepted by DTL after discussion. However, in case detailed valid programme approved by DTL for the equipment already exist, same would be followed till its validity. A quality assurance programme of the contractor shall generally cover the following:

(a) His organization structure for the management and implementation of the proposed quality assurance program:

(b) Documentation control system;

(c) Qualification data for bidder's key personnel;

(d) The procedure for purchases of materials, parts components and selection of sub-Contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.

(e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;

(f) Control of non-conforming items and system for corrective actions;

(g) Inspection and test procedure both for manufacture and field activities.

(h) Control of calibration and testing of measuring instruments and field activities;

(i) System for indication and appraisal of inspection status;

(j) System for quality audits;

(k) System for authorising release of manufactured product to the Purcahser.

(l) System for maintenance of records;

(m) System for handling storage and delivery; and

(n) A quality plan detailing out the specific quality control measures and procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered.

The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor/his vendor's quality management and control activities.

8.2 Quality Assurance Documents

The contractor would be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of purchaser's inspection of equipment/material

9.0 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE

9.1 All equipment being supplied shall conform to type tests including additional type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the type tests. The Contractor shall intimate the Purchaser the detailed program about the tests atleast three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies.

9.2 The reports for all type tests and additional type tests as per technical specification shall be furnished by the Contractor alongwith equipment / material drawings as per relevant IEC with latest amendments. The type tests conducted should have either been conducted in accredited laboratory (accredited based on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accreditation body of the country where laboratory is located) or witnessed by the representative(s) of DTL or Utility. The test reports submitted shall be of the tests conducted within last 10 (ten) years prior to the date of bid opening.
In case the test reports are of the test conducted earlier than 10 (ten) years prior to the date of bid opening, the contractor shall repeat these test(s) at no extra cost to the purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design / manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification or any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

9.3 Bidder shall conduct type tests on equipments other than GIS if required in their respective section.

9.4 The Purchaser, his duly authorised representative and/or outside inspection agency acting on behalf of the Purchaser shall have at all reasonable times free access to the Contractor's/sub-vendors premises or Works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the Works during its manufacture or erection if part of the Works is being manufactured or assembled at other premises or works, the Contractor shall obtain for the Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, despatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

9.5 The Contractor shall give the Purchaser /Inspector thirty (30) days written notice of any material being ready for joint testing including contractor and DTL. Such tests shall be to the Contractor's account except for the expenses of the Inspector. The Purchaser / inspector, unless witnessing of the tests is virtually waived, will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed alone with the test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of tests in triplicate.

9.6 The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser /Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

9.7 When the factory tests have been completed at the Contractor's or Sub-Contractor's works, the Purchaser/inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser /Inspector, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Engineer/Inspector. Failure of the Purchaser /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should, it, on further tests after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of CIP by the Purchaser.

9.8 In all cases where the Contract provides for tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and

instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give facilities to the Purchaser /Inspector or to his authorised representative to accomplish testing.

9.9 The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.

9.10 The Purchaser will have the right of having at his own expenses any other test(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests, to satisfy that the material comply with the specification.

9.11 The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipments for these tests shall be provided by the Purchaser.

10. TESTS

10.1 Pre-commissioning Tests

On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Purchaser and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The list of pre-commissioning tests to be performed are given in respective chapters and shall be included in the Contractor's quality assurance programme.

10.2 Commissioning Tests

10.2.1 The testing equipments required for testing and commissioning shall be arranged by the Contractor.

10.2.2 The specific tests requirement on equipment have been brought out in the respective chapters of the technical specification.

10.3 The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning the equipment and the switchyard. However necessary fee shall be reimbursed by DTL on production of requisite documents.

11.0 PACKAGING & PROTECTION

11.1 All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the Purchaser, the Contractor shall also submit packing details/associated drawing for any equipment/material under his scope of supply, to facilitate the Purchaser to repack any equipment/material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

11.2 All coated surfaces shall be protected against abrasion, impact, discolouration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves and pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

12.0 FINISHING OF METAL SURFACES

12.1 All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts & bolts and spring washers shall be electro galvanized to service condition 4. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.

12.2 HOT DIP GALVANISING

12.2.1 The minimum weight of the zinc coating shall be 610 gm/sq. m and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6mm thickness requirement of coating thickness shall be as per relevant ASTM. For surface which shall be embedded in concrete, the zinc coating shall be 610 gm/sq. m minimum.

12.2.2 The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

12.2.3 After galvanizing. no drilling or welding shall be performed on the galvanized parts of the equipment excepting that nuts may be threaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

12.2.4 The galvanized steel shall be subjected to six one minute dips in copper sulphate solution as per IS-2633.

12.2.5 Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanizing tests should essentially be performed as per relevant Indian Standards.
- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

12.2.6 Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

12.3 PAINTING

12.3.1 All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS-6005 “Code of practice for phosphating iron and sheet”. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swaf 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.

12.3.2 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, stoving type zinc chromate primer. The first coat may be “flash dried” while the second coat shall be stoved.

12.3.3 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.

12.3.4 The exterior colour of the paint shall be as per shade no: 697 (for outdoor) & 692 (for indoor) of IS-5 and inside shall be glossy white for all equipment, marshalling boxes, junction boxes, control cabinets, panels etc. unless specifically mentioned under respective sections of the equipments. Each coat of primer and finishing paint shall be of slightly different shade to enable inspection of the painting. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipments.

12.3.5 In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted alongwith the Bids for Purchaser’s review & approval.

12.3.6 The colour scheme as given below shall be followed for Fire Protection and Air Conditioning systems

S.No	PIPE LINE	Base colour	Band colour
Fire Protection System			
1	Hydrant and Emulsifier system pipeline	FIRE RED	-
2	Emulsifier system detection line – water	FIRE RED	Sea Green
3	Emulsifier system detection line	FIRE RED	Sky Blue

	–Air		
4	Pylon support pipes	FIRE RED	
Air Conditioning System			
5	Refrigerant gas pipeline – at compressor suction	Canary Yellow	**-**
6	Refrigerant gas pipeline – at compressor discharge	Canary Yellow	Red
7	Refrigerant liquid pipeline	Dark Admiralty Green	-
8	Chilled water pipeline	Sea Green	-
9	Condenser water pipeline	Sea Green	Dark Blue

The direction of flow shall be marked by → (arrow) in black colour.

Base Colour Direction of flow Band Colour

13.0 HANDLING, STORING AND INSTALLATION

13.1 In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

13.2 Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

13.3 In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

13.4 Where assemblies are supplied in more than one section, Contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.

13.5 Contractor shall be responsible for examining all the shipment and notify the Purchaser immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the Purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

13.6 The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of nature, corrosion, damages etc.

13.7 Where material / equipment is unloaded by Purchaser before the Contractor arrives at site or even when he is at site, Purchaser by right can hand over the same to Contractor and there upon it will be the responsibility of Contractor to store the material in an orderly and proper manner.

13.8 The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which requires indoor storage.

13.9 The words 'erection' and 'installation' used in the specification are synonymous.

13.10 Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

13.11 The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances as given in clause 4.7.1 the Contractor shall immediately proceed to correct the discrepancy at his risks and cost.

13.12 Equipment Bases

A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have
threaded drain connections.

14.0 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

15.0 AUXILIARY SUPPLY

15.1 The sub-station auxiliary supply is normally met through a system indicated under section "Electrical & Mechanical Auxiliaries" having the following parameters. The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation shall also conform the parameters as indicated in the following.

Normal Voltage connection	Variation in Voltage	Frequency in HZ	Phase /Wire	Neutral
415V	+/- 10%	50 +/- 5%	3/ 4 Wire	Solidly Earthed
240V	+/- 10%	50 +/- 5%	1/ 2 Wire	Solidly Earthed
220V System	190V to240V	DC	-	Isolated 2 wire
50V (+) earthed	_	DC	_	2 wire system

Combined variation of voltage and frequency shall be limited to +/-10%.

16.0 SUPPORT STRUCTURE

The Contractor is required to supply standard structures of various equipments. Bidder may also refer relevant Clauses of Section (Civil) in this regard.

17.0 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

17.1 All power clamps and connectors shall conform to IS:5561 & NEM CC1 and shall be made of materials listed below :

a) For connecting ACSR conductors	Aluminum alloy casting, conforming to designation A6 of IS:617 and all test shall conform to IS:617
b) For connecting equipment ter-minals made of copper with ACSR conductors	Bimetallic connectors made from aluminum alloy casting, conforming to designation A6 of IS 617 with 2mm thick bimetallic liner and all test shall conform to IS:617
c) For connecting G.I wire	Galvanised mild steel shield

i) Bolts, nuts & Plain, washers	i) Electrogalvanised for sizes below M12, for others hot dip galvanised.
ii) Spring washers for items 'a' to 'c'	ii) Electro-galvanised mild steel suitable for atleast service condition-3 as per IS:1573

17.2 Each equipment shall be supplied with the necessary terminals and connectors, as required by the ultimate design for the particular installation. The conductor terminations of equipment shall be either expansion, sliding or rigid type suitable for 4" IPS (OD : 114.2 mm, ID: 97.18 mm) aluminum tube or suitable for Quad/Twin ACSR / AAAC Conductor (250 mm Sub- Conductor spacing for 220 kV). The requirement regarding external corona and RIV as specified for any equipment shall include its terminal fittings and the equipment shall be factory tested with the connectors in position. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of work.

17.3 Where copper to aluminum connections are required, bi-metallic clamps shall be used, which shall be properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current carrying or subjected to stress. The design details of the joint shall be furnished to the Purchaser by the Contractor.

17.4 Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified in each particular case, are also included in the scope of Work.

17.5 No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2 mm thickness shall be cast integral with aluminum body for Bi-metallic clamps.

17.6 All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

17.7 Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of 4" IPS AL. tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

17.8 Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.

17.9 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

17.10 Clamps and connectors shall be designed to be corona controlled. Corona extinction voltage for 220 kV class clamps shall not be less than 156 kV and R.I.V. level shall not be more than 1000 micro volts at the test voltage specified in respective sections.

17.11 Tests

17.11.1 Clamps and connectors should be type tested as per IS:5561 and shall also be subjected to routine tests as per IS:5561. Following type test reports on three samples of similar type shall be submitted for approval as per clause 9.2 above except for sl. no.(ii) & (iii) for which type test once conducted shall be applicable (i.e. the requirement of test conducted within last five years shall not be applicable).

i) Temperature rise test (maximum temperature rise allowed is 35° C over 50°C ambient)
ii) Short time current test
iii) Corona (dry) and RIV (dry) test (for 220 KV and above voltage level clamps)
iv) Resistance test and tensile test

18.0 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT

18.1 All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS-5039/IS-8623, IEC-439, as applicable, and the clauses given below:

18.2 Control cabinets, junction boxes, Marshalling boxes & terminal boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be atleast 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

18.3 Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes / Control cabinets to prevent ingress of rain water.

18.4 Cabinet/boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of the gasket shall be such that it does not get damaged/cracked during the operation of the equipment.

18.5 All doors, removable covers and plates shall be gasketed all around with suitably profiled EPDM gaskets. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged/cracked during the ten years of operation of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

18.6 All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connnections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting at least 150 mm above the base of the marshalling kiosk/box shall be provided for this purpose along with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland plate. The gland shall project at least 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required. The Nickel plated glands shall be dust proof, screw on & double compression type and made of brass. The gland shall have provision for securing armour of the cable separately and shall be provided with earthing tag. The glands shall conform to BS:6121.

18.7 A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps. Plug and socket shall be of industrial grade.

18.8 For illumination of a 20 Watts flourscent tube or 15 watts CFL shall be provided. The switching of the fittings shall be controlled by the door switch.

18.9 All control switches shall be of rotary switch type and Toggle/piano switches shall not be accepted. However, Spring return type actuator switch for ON/Off control are acceptable.

18.10 Positive earthing of the cabinet shall be ensured by providing two separate earthing pads. The earth wire shall be terminated on to the earthing pad and secured by the use of self etching washer. Earthing of hinged door shall be done by using a separate earth wire.

18.11 The bay marshalling kiosks shall be provided with danger plate and a diagram showing the numbering/connection/feruling by pasting the same on the inside of the door.

18.12 a) The following routine tests alongwith the routine tests as per IS:5039 shall also be conducted:
i) Check for wiring
ii) Visual and dimension check

b) The enclosure of bay marshalling kiosk, junction box, terminal box shall conform to IP-55 as per IS:13947 including application of, 2.5 KV rms for 1 (one) minute, insulation resistance and functional test after IP-55 test.

19.0 Auxiliary Switches (Applicable for isolators and circuit breakers)

The following type test reports on auxiliary switches shall be submitted for approval:

(a) Electrical endurance test - A minimum of 2000 operation for 2A D. C. with a time constant greater than or equal to 20 millisecond with a subsequent examination of mV drop/visual defects/temperature rise test.
(b) Mechanical endurance test. A minimum of 1,00,000 operations with a subsequent checking of contact pressure test/visual examination.
(c) Heat run test on contacts.
(d) IR/HV test etc.

20.0 TERMINAL BLOCKS AND WIRING

20.1 Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All interphase and external connections to equipment or to control cubicles will be made through terminal blocks.

20.2 Terminal blocks shall be 650 V grade and have continuous rating to carry the maximum expected current on the terminals. These shall be of moulded piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be nondisconnecting stud type equivalent to Elmex type CATM4, Phoenix cage clamp type of Wago or equivalent.

20.3 Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

20.4 The terminal shall be such that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally.

20.5 The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable.
20.6 The terminal blocks shall be of extensible design.
20.7 The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.
20.8 The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

20.9 Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

a) All circuits except Minimum of two of 2.5 sq mm CT circuits copper flexible.
b) All CT circuits Minimum of 4 nos. of 2.5 sq mm copper flexible.

20.10 The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

20.11 Atleast 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

20.12 There shall be a minimum clearance of 250 mm between the First/bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.

20.13 The Contractor shall furnish all wire, conduits and terminals for the necessary interphase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

20.14 All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The

Contractor shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment

21.0 LAMPS AND SOCKETS

21.1 Lamps

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

21.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

21.3 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

21.4 Switches and Fuses:

21.4.1 Each panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switchfuse units. Selection of the main and Sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. Potential circuits for relaying and metering shall be protected by HRC fuses.

21.4.2 All fuses shall be of HRC cartridge type conforming to IS: 9228 mounted on plug-in type fuse bases. Miniature circuit breakers with thermal protection and alarm contacts will also be accepted. All accessible live connection to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carrier base shall have imprints of the fuse rating and voltage.

22.0 Bushings, Hollow Column Insulators, Support Insulators:

22.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5621. The support insulators shall be manufactured and tested as per IS 2544/IEC 168 and IEC 273. The insulators shall also conform to IEC 815 as applicable. The bidder may also offer composite silicon insulator, conforming to IEC-61109.

22.2 Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

22.3 Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and similar other defects.

22.4 Support insulators/bushings/hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

22.5 When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators/bushings when operating at the normal rated voltage.

22.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

22.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up porcelain parts by grinding and metal parts by machining. Insulator/bushing design shall be such as to ensure a uniform compressive pressure on the joints.

22.8 Tests

In bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS: 2099 & IS: 2544 & IS : 5621. The type test reports shall be submitted for approval.

23.0 Motors

Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall be subjected to routine tests as per applicable standards. The motors shall be of approved make.

23.1 Enclosures

a) Motors to be installed outdoor without enclosure shall have hose proof enclosure equivalent to IP 55 as per IS: 4691. For motors to be installed indoor i.e. inside a box, the motor enclosure, shall be dust proof equivalent to IP 44 as per IS: 4691.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting from condensation or other causes from all pockets in the motor casing.
d) Motors weighing more than 25 Kg. shall be provided with eyebolts, lugs other means to facilitate lifting.

23.2 Operational Features

a) Continuous motor rating (name plate rating) shall be at least ten (10) percent above the maximum load demand of the driven equipment at design duty point and the motor shall not be over loaded at any operating point of driven equipment that will rise in service.
b) Motor shall be capable at giving rated output without reduction in the expected life span when operated continuously in the system having the particulars as given in Clause 15.0 of this Section.

23.3 Starting Requirements:

a) All induction motors shall be suitable for full voltage direct-online starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops down to 80% of the rated voltage.
b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
c) The locked rotor current shall not exceed six (6) times the rate full load current for all motors, subject to tolerance as given in IS: 325.
d) Motors when started with the driven equipment imposing full starting torque under the supply voltage conditions specified under Clause 15.0 shall be capable of withstanding atleast two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by at least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Bidder shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speed lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% of the rated speed in either direction of rotation.

23.4 Running Requirements:

a) The maximum permissible temperature rise over the ambient temperature of 50 degree C shall be within the limits specified in IS: 325 (for 3 - phase induction motors) after adjustment due to increased ambient temperature specified.
b) The double amplitude of motor vibration shall be within the limits specified in IS: 4729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.
c) All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes with rated load commencing from hot condition.

23.5 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 Contractor 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.
(b) Phase sequence and proper direction of rotation.
(c) Any motor operating incorrectly shall be checked to determine the cause and the conditions corrected.

24.0 TECHNICAL REQUIREMENT OF EQUIPMENTS

24.1 Circuit Breakers

a. The manufacturer(s) whose Circuit Breaker are offered should have designed, manufactured tested as per IEC/IS or equivalent standard supplied the same for the specified system voltage and which are in satisfactory operation for at least 2 (two) years as on the date of bid opening.

Or

b. The manufacturer(s) whose Circuit Breaker are offered who have recently established production line in India for the specified system voltage or above class, based on technological support of a parent company or collaborator for the respective equipment(s) can also be considered provided the parent company (Principal) or collaborator meets qualifying requirements stipulated under clause no 24.1.a given above.

And

Furnishes (jointly with parent company or collaborator) a legally enforceable undertaking to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s)

And

Furnishes a confirmation letter from the parent company or collaborator alongwith the bid stating that parent company or collaborator shall furnish performance guarantee for an amount of 10% of the cost of such equipment(s). This performance guarantee shall be in addition to contract performance guarantee to be submitted by the Bidder

24.2 Isolators

The manufacturer whose isolators are offered, should have designed, manufactured, tested as per IEC/IS or equivalent standard and supplied the isolator for the specified system voltage and fault level and should be in satisfactory operation for at least 2 (two) years as on the date of bid opening.

24.3 Instrument Transformers

The manufacturer whose instrument transformers are offered, should have designed, manufactured & tested as per IS/IEC or equivalent standard and supplied the same for the specified system voltage for CT & CVT and fault level in case of CT. These equipment should be in satisfactory operation for at least 2 (two) years as on the date of bid opening.

24.4 Surge Arresters

The manufacturer whose Surge Arresters are offered should have designed, manufactured and tested as per IEC/IS or equivalent standard and supplied the Surge Arrester for the specified energy capability with rated system voltage and which are in satisfactory operation for at least 2 (two) years as on the date of bid opening.

24.5 1.1 kV Grade Power & Control Cables

24.5.1 Applicable for PVC Control Cable

The manufacturers, whose PVC control cables are offered, should have designed, manufactured, tested and supplied in a single contract at least 100 Kms of 1.1 kV grade PVC insulated control cables as on the date of bid opening. Further the manufacturer should also have designed, manufactured, tested and supplied at least 1 km of 27C x 2.5 Sq.mm or higher size as on the date of bid opening.

24.5.2 Applicable for PVC Power Cable

The manufacturer, whose PVC Power Cables are offered, should have designed, manufactured, tested and supplied in a single contract atleast 100 Kms of 1.1 kV or higher grade PVC insulated power cables as on the date of bid opening . Further the manufacturer should also have designed, manufactured, tested and supplied at least 1 km of 1C x 150 Sq. mm or higher size as on the date of bid opening.

24.5.3 Applicable for XLPE Power Cables

The Manufacturer, whose XLPE Power cables are offered, should have designed, manufactured, tested and supplied in a single contract atleast 25 Kms of 1.1 kV or higher grade XLPE insulated power cables as on the date of bid opening . Further the manufacturer should also have designed, manufactured, tested and supplied at least 1 km of 1C x 630 Sq. mm or higher size as on the date of bid opening.

24.6 LT Switchgear

24.6.1 The Manufacturer whose LT Switchgear are offered, should be a manufacturer of LT Switchboards of the type and rating being offered. He should have designed, manufactured, tested and supplied at least 50 nos. draw out circuit breaker panels, out of which at least 5 nos. should have been with relay and protection schemes with current transformer. He should have also manufactured at least 50 nos. motor control center panels of the type and rating being offered which should be in successful operation as on date of bid opening.

24.6.2 The Switchgear items (such as circuit breakers, fuse switch units, contactors etc.), may be of his own make or shall be procured from reputed manufacturers and of proven design. At least one hundred circuit breakers of the make and type being offered shall be operating satisfactory as on date of bid opening.

24.7 Battery and Battery Charger

24.7.1 Requirements for Battery Manufacturers

The manufacturer whose Batteries are offered should have designed, manufactured and supplied DC Batteries of the type specified and being offered, having a capacity of at least 600 AH and these shall be operating satisfactorily for two years in power sector and/or industrial installations as on date of bid opening.

24.7.2 Requirements for Battery Charger Manufacturers

The manufacturer, whose Battery Chargers are offered, should have designed, manufactured and supplied Battery Chargers generally of the type offered, with static automatic voltage regulators and having a continuous output of atleast ten (10) KW and these should be in successful as on the date of bid opening.

24.8 LT Transformers

The manufacturer, whose transformers are offered should have designed, manufactured, type tested including short circuit test as per IEC/IS or equivalent standards and supplied transformers of at least 33 kV class of 800 kVA or higher. The transformer should have been in successful operation for at least 2 years as on the date of bid opening.

24.9 Fire Fighting System

Nitrogen Injection Fire Prevention and Extinguishing System shall be used for fire protection of Transformer. In addition fire protection wall shall be erected between the two transformers which have adjacent base. Portable Fire Extinguishers shall also be provided.

24.10 Control and Relay Panels

24.10.1 The manufacturer whose C&R panels and protective relay are offered should have designed, manufactured, tested, installed and commissioned C&R panels including protection relays which must be in satisfactory operation on 220 kV system for atleast 2 (two) years on the date of bid opening.

24.10.2 The C&R Panel from a manufacturer whose have designed, manufactured, tested, installed and commissioned C&R panels which are in satisfactory operation on 220 kV system for atleast 2 (two) years on the date of bid opening can also be offered, provided the protective relay schemes should be offered from a Contractor who fully meets the requirements stipulated under clause 24.10.1 above. Further, in such an event the manufacturer shall furnish an undertaking jointly executed by him and his protective relay schemes Supplier, as per the format enclosed in the bid documents for successful performance of the protection system offered.

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ANNEXURE-A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1. General

Unless otherwise stipulated, all equipment (except Auto Transformer) together with its associated connectors, where applicable, shall be tested for external corona both by observing the voltage level for the extinction of visible corona under falling power frequency voltage and by measurement of radio interference voltage (RIV).

2. Test Levels:

The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.

3. Test Methods for RIV:

3.1 RIV tests shall be made according to measuring circuit as per International Special-Committee on Radio Interference (CISPR) Publication 16-1(1993) Part -1. The measuring circuit shall preferably be tuned to frequency with 10% of 0.5 Mhz but other frequencies in the range of 0.5 MHz to 2 MHz may be used, the measuring frequency being recorded. The results shall be in microvolts.

3.2 Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107-1964, except otherwise noted herein.

3.3 In measurement of, RIV, temporary additional external corona shielding may be provided. In measurements of RIV only standard fittings of identical type supplied with the equipment and a simulation of the connections as used in the actual installation will be permitted in the vicinity within 3.5 meters of terminals.

3.4 Ambient noise shall be measured before and after each series of tests to ensure that there is no variation in ambient noise level. If variation is present, the lowest ambient noise level will form basis for the measurements. RIV levels shall be measured at increasing and decreasing voltages of 85%, 100%, 115% and 130% of the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 220 kV is listed in the detailed specification together with maximum permissible RIV level in microvolts.

3.5 The metering instruments shall be as per CISPR recommendation or equivalent device so long as it has been used by other testing authorities.

3.6 The RIV measurement may be made with a noise meter. A calibration procedure of the frequency to which noise meter shall be tuned shall establish the ratio of voltage at the high voltage terminal to voltage read by noise meter.

4.0 Test Methods for Visible Corona

The purpose of this test is to determine the corona extinction voltage of apparatus, connectors etc. The test shall be carried out in the same manner as RIV test described above with the exception that RIV measurements are not required during test and a search technique shall be used near the onset and extinction voltage, when the test voltage is raised and lowered to determine their precise values. The test voltage shall be raised to 130% of RIV test voltage and maintained there for five minutes. In case corona inception does not take place at 130 %, test shall be stopped, otherwise test shall be continued and the voltage will then be decreased slowly until all visible corona disappears. The procedure shall be repeated at least 4 times with corona inception and extinction voltage recorded each time. The corona extinction voltage for purposes of determining compliance with the specification shall be the lowest of the four values at which visible corona (negative or positive polarity) disappears. Photographs with laboratory in complete darkness shall be taken under test conditions, at all voltage steps i.e. 85%, 100%, 115% and 130%. Additional photographs shall be taken at corona inception and extinction voltages. At least two views shall be photographed in each case using Panchromatic film with an ASA daylight rating of 400 with an exposure of two minutes at a lens aperture of f/5.6 or equivalent. The photographic process shall been such that prints are available for inspection and comparison with conditions as determined from direct observation. Photographs shall be taken from above and below the level of connector so as to show corona on bushing, insulators and all parts of energised connectors. The photographs shall be framed such that test object essentially, fills the frame with no cut-off.

4.1 The test shall be recorded on each photograph. Additonal photograph shall be taken from each camera position with lights on to show the relative position of test object to facilitate precise corona location from the photographic evidence.

4.2 In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of all the test equipment and test objects. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by Purchaser's inspector, after determining the best camera locations by trial energisation of test object at a voltage which results in corona.

4.3 The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.

4.4 However, both test shall be carried out with the same test set up and as little time duration between tests as possible. No modification on treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of Purchaser's inspector if, in his opinion, it will not prejudice other test.

5. Test Records:

In addition to the information previously mentioned and the requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in test report:

a) Background noise before and after test.
b) Detailed procedure of application of test voltage.
c) Measurements of RIV levels expressed in micro volts at each level.
d) Results and observations with regard to location and type interference sources detected at each step.
e) Test voltage shall be recorded when measured RIV passes through 100 microvolts in each direction.
f) Onset and extinction of visual corona for each of the four tests required shall be recorded.

ANNEXURE – B

SEISMIC WITHSTAND TEST PROCEDURE

The seismic withstanding test on the complete equipment (except Auto Transformer) shall be carried out alongwith supporting structure. The Bidder shall arrange to transport the structure from his Contractor's premises/DTL sites for the purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the Terminal Pad of the equipment and any other point as agreed by the Purchaser. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Purchaser.

ANNEXURE - C

LIST OF SPECIFICATIONS

GENERAL STANDARDS AND CODES

India Electricity Rules
Indian Electricity Act
Indian Electricity (Supply) Act
Indian Factories Act

IS-5,	-	Colors for Ready Mixed Paints and Enamels.
IS-335,	-	New Insulating Oils.
IS-617,	-	Aluminium and Aluminium Alloy Ingots and
	-	Castings for General Engineering Purposes
IS-1448 (P1 to P 145)	-	Methods of Test for Petroleum and its Products.
IS-2071 (P1 to P3)	-	Methods of High Voltage Testing.
IS-12063	-	Classification of degrees of protection provided by enclosures of electrical equipment.
IS-2165 P1:1997 P2:1983	-	Insulation Coordination.
IS-3043	-	Code of Practice for Earthing
IS-6103	-	Method of Test for Specific Resistance(Resistivity) of Electrical Insulating Liquids
IS-6104	-	Method of Test for Interfacial Tension of Oil against Water by the Ring Method
IS-6262	-	Method of test for Power factor & Dielectric Constant of Electrical Insulating Liquids.
IS-6792	-	Method for determination of electric strength of insulating oils.
IS-5578	-	Guide for marking of insulated conductors.
IS-11353	-	Guide for uniform system of marking & identification of conductors & apparatus terminals.
IS-8263	-	Methods for Radio Interference Test on High voltage Insulators.
IS-9224 (Part 1,2&4)	-	Low Voltage Fuses
IEC-60060 (Part 1 to P4)	-	High Voltage Test Techniques
IEC 60068	-	Environmental Test
IEC-60117	-	Graphical Symbols
IEC-60156,	-	Method for the Determination of the Electrical Strength of Insulation Oils.
IEC-60270,	-	Partial Discharge Measurements.
IEC-60376	-	Specification and Acceptance of New Sulphur Hexafloride
IEC-60437	-	Radio Interference Test on High Voltage Insulators.
IEC-60507	-	Artificial Pollution Tests on High Voltage Insulators to be used on AC Systems.
IEC-60694	-	Common Specification for High Voltage Switchgear & Controlgear Standards.
IEC-60815	-	Guide for the Selection of Insulators in respect of Polluted Conditions.
IEC-60865 (P1 & P2)	-	Short Circuit Current - Calculation of effects.
ANSI-C.1/NFPA.70	-	National Electrical Code
ANSI-C37.90A	-	Guide for Surge Withstand Capability (SWC) Tests
ANSI-C63.21,	-	Specification for Electromagnetic Noise and
C63.3	-	Field Strength Instrumentation 10 KHz to 1 GHZ
C36.4ANSI-C68.1	-	Techniquest for Dielectric Tests
ANSI-C76.1/EEE21	-	Standard General Requirements and Test Procedure for Outdoor Apparatus Bushings.
ANSI-SI-4	-	Specification for Sound Level Metres
ANSI-Y32-2/C337.2	-	Drawing Symbols

ANSI-Z55.11	-	Gray Finishes for Industrial Apparatus and Equipment No. 61 Light Gray
NEMA-107T	-	Methods of Measurements of RIV of High Voltage Apparatus
NEMA-ICS-II	-	General Standards for Industrial Control and Systems Part ICSI-109
CISPR-1	-	Specification for CISPR Radio Interference Measuring Apparatus for the frequency range 0.15 MHz to 30 MHz
CSA-Z299.1-1978h	-	Quality Assurance Program Requirements
CSA-Z299.2-1979h	-	Quality Control Program Requirements
CSA-Z299.3-1979h	-	Quality Verification Program Requirements
CSA-Z299.4-1979h	-	Inspection Program Requirements

TRANSFORMERS AND REACTORS

IS:10028 (Part 2 & 3)	-	Code of practice for selection, installation & maintenance of Transformers (P1:1993) (P2:1991), (P3:1991)
IS-2026 (P1 to P4)	-	Power Transformers
IS-3347 (part 1 to Part 8)	-	Dimensions for Porcelain transformer Bushings for use in lightly polluted atmospheres.
IS-3639	-	Fittings and Accessories for Power Transformers
IS-6600	-	Guide for Loading of Oil immersed Transformers.
IEC-60076 (Part 1 to Part 5)	-	Power Transformers
IEC-60214	-	On-Load Tap-Changers.
IEC-60289	-	Reactors.
IEC- 60354	-	Loading Guide for Oil - Immersed power transformers
IEC-60076-10	-	Determination of Transformer and Reactor Sound Levels
ANSI-C571280	-	General requirements for Distribution, Power and Regulating Transformers
ANSI-C571290	-	Test Code for Distribution, Power and Regulation Transformers
ANSI-C5716	-	Terminology & Test Code for Current Limiting Reactors
ANSI-C5721	-	Requirements, Terminology and Test Code for Shunt Reactors Rated Over 500 KVA
ANSI-C5792	-	Guide for Loading Oil-Immersed Power Transformers upto and including 100 MVA with 55 deg C or 65 deg C Winding Rise
ANSI-CG,1EEE-4	-	Standard Techniques for High Voltage Testing

CIRCUIT BREAKERS

IEC-62271-100	-	High Voltage Alternating Current Breakers
IEC-60427	-	Synthetic Testing of High Voltage alternating current circuit Breakers.
IEC-61264	-	Pressurised Hollow Column Insulators

CURRENT TRANSFORMERS, VOLTAGE TRANSFORMERS AND COUPLING CAPACITOR VOLTAGE TRANSFORMERS

IS-2705	-	(P1 to P4) - Current Transformers.
IS:3156	-	(P1 to P4) - Voltage Transformers.
IS-4379	-	Identification of the Contents of Industrial Gas Cylinders
IEC-60044-1	-	Current transformers.
IEC-60044-2	-	Voltage Transformers.
IEC-60358	-	Coupling capacitors and capacitor dividers.
IEC-60044-4	-	Instrument Transformes : Measurement of Partial Discharges
IEC-60481	-	Coupling Devices for power Line Carrier Systems.
ANSI-C5713	-	Requirements for Instrument transformers
ANSIC92.2	-	Power Line Coupling voltage Transformers
ANSI-C93.1	-	Requirements for Power Line Carrier Coupling
Capacitors		
BUSHING		
IS-2099	-	Bushings for Alternating Voltages above1000V
IEC-60137	-	Insulated Bushings for Alternating Voltages above1000V

SURGE ARRESTERS

IS-3070 (PART2)	-	Lightning arresters for alternating current systems : Metal oxide lightning arrestors without gaps.
IEC-60099-4	-	Metal oxide surge arrestors without gaps
IEC-60099-5	-	Selection and application recommendation
ANSI-C62.1	-	IEE Standards for S A for AC Power Circuits

NEMA-LA 1	-	Surge Arresters

CUBICLES AND PANELS & OTHER RELATED EQUIPMENTS

IS-722, IS-1248, IS-3231, 3231 (P-3)	-	Electrical relays for power system protection
IS:5039	-	Distributed pillars for Voltages not Exceeding 1000 Volts.
IEC-60068.2.2	-	Basic environmental testing procedures Part 2: Test B: Dry heat
IEC-60529	-	Degree of Protection provided by enclosures.
IEC-60947-4-1	-	Low voltage switchgear and control gear.
IEC-61095	-	Electromechanical Contactors for household and similar purposes.
IEC-60439 (P1 & 2)	-	Low Voltage Swtichgear and control gear assemblies
ANSI-C37.20	-	Switchgear Assemblies, including metal enclosed bus.
ANSI-C37.50	-	Test Procedures for Low Voltage Alternating Current Power Circuit Breakers
ANSI-C39	-	Electric Measuring instrument
ANSI-C83	-	Components for Electric Equipment
IS: 8623: (Part I to 3)	-	Specification for Switchgear & Control Assemblies.
NEMA-AB	-	Moulded Case Circuit and Systems
NEMA-CS	-	Industrial Controls and Systems
NEMA-PB-1	-	Panel Boards
NEMA-SG-5	-	Low voltage Power Circuit breakers
NEMA-SG-3	-	Power Switchgear Assemblies
NEMA-SG-6	-	Power switching Equipment
NEMA-5E-3	-	Motor Control Centers
1248 (P1 to P9)	-	Direct acting indicating analogue electrical measuring instruments & their accessories.

Disconnecting switches

IEC-60129	-	Alternating Current Disconnectors (Isolators) and Earthing switches
IEC-1129	-	Alternating Current Earthing Switches Induced Current switching
IEC-60265 (Part 1 & Part 2)	-	High Voltage switches
ANSI-C37.32	-	Schedule of preferred Ratings, Manufacturing Specifications and Application Guide for high voltage Air Switches, Bus supports and switch accessories
ANSI-C37.34	-	Test Code for high voltage air switches
NEMA-SG6	-	Power switching equipment

PLCC and line traps

IS-8792	-	Line traps for AC power system.
IS-8793	-	Methods of tests for line traps.
IS-8997	-	Coupling devices for PLC systems.
IS-8998	-	Methods of test for coupling devices for PLC systems.
IEC-60353	-	Line traps for A.C. power systems.
IEC-60481	-	Coupling Devices for power line carrier systems.
IEC-60495	-	Single sideboard power line carrier terminals
IEC-60683	-	Planning of (single Side-Band) power line carrier systems.
CIGRE	-	Teleprotection report by Committee 34 & 35.
CIGRE	-	Guide on power line carrier 1979.
CCIR	-	International Radio Consultative Committee
CCITT	-	International Telegraph & Telephone Consultative Committee
EIA	-	Electric Industries Association

Protection and control equipment

IEC-60051 : (P1 to P9)	-	Recommendations for Direct Acting indicating analogue electrical measuring instruments and their accessories.
IEC-60255 (Part 1 to part 23)	-	Electrical relays.
IEC-60297		

(P1 to P4)	-	Dimensions of mechanical structures of the 482.6mm (19 inches) series.
IEC-60359	-	Expression of the performance of electrical & electronic measuring equipment.
IEC-60387	-	Symbols for Alternating-Current Electricity meters.
IEC-60447	-	Man machine interface (MMI) - Actuating principles.
IEC-60521	-	Class 0.5, 1 and 2 alternating current watt hour metres
IEC-60547	-	Modular plug-in Unit and standard 19-inch rack mounting unit based on NIM Standard (for electronic nuclear instruments)
ANSI-81	-	Bolts and Nuts
ANSI-C37.1	-	Relays, Station Controls etc.
ANSI-C37.2	-	Manual and automatic station control, supervisory and associated Telemetering equipment
ANSI-C37.2	-	Relays and relay systems associated with electric power apparatus
ANSI-C39.1	-	Requirements for electrical analog indicating instruments

MOTORS

IS-325	-	Three phase induction motors.
IS-4691	-	Degree of protection provided by enclosure for rotating electrical machinery.
IEC-60034 (P1 to P19:)	-	Rotating electrical machines
IEC-Document 2	-	Three phase induction motors (Central Office) NEMA-MGI Motors and Generators

Electronic equipment and components

MIL-21B, MIL-833 & MIL-2750

IEC-60068 (P1 to P5)	-	Environmental testing
IEC-60326 (P1 to P2)	-	Printed boards Material and workmanship standards
IS-1363 (P1 to P3)	-	Hexagon headbolts, screws and nuts of product grade C.
IS-1364 (P1 to P5)	-	Hexagon head bolts, screws and nuts of products grades A and B.
IS-3138	-	Hexagonal Bolts and Nuts (M42 to M150)
ISO-898	-	Fasteners: Bolts, screws and studs
ASTM	-	Specification and tests for materials

Clamps & connectors

IS-5561	-	Electric power connectors.
NEMA-CC1	-	Electric Power connectors for sub station
NEMA-CC 3	-	Connectors for Use between aluminium or aluminum- Copper Overhead Conductors

Bus hardware and insulators

IS: 2121	-	Fittings for Aluminum and steel cored Al conductors for overhead power lines.
IS-731	-	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000 V.
IS-2486 (P1 to P4)	-	Insulator fittings for overhead power lines with a nominal voltage greater than 1000 V.
IEC-60120	-	Dimensions of Ball and Socket Couplings of string insulator units.
IEC-60137	-	Insulated bushings for alternating voltages above 1000 V.
IEC-60168	-	Tests on indoor and outdoor post insulators of ceramic material or glass for Systems with Nominal Voltages Greater than 1000 V.
IEC-60233	-	Tests on Hollow Insulators for use in electrical equipment.
IEC-60273	-	Characteristices of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
IEC-60305	-	Insulators for overhead lines with nominal voltage above 1000V-ceramic or glass insulator units for a.c. systems Characteristics of String Insulator Units of the cap and pintype.
IEC-60372 (1984)	-	Locking devices for ball and socket couplings of string insulator units : dimensions and tests.
IEC-60383 (P1 and P2)	-	Insulators for overhead lines with a nominal

		voltage above 1000 V.
IEC-60433	-	Characteristics of string insulator units of the long rod type.
IEC-60471	-	Dimensions of Clevis and tongue couplings of string insulator units.
ANSI-C29	-	Wet process porcelain insulators
ANSI-C29.1	-	Test methods for electrical power insulators
ANSI-C92.2	-	For insulators, wet-process porcelain and toughened glass suspension type
ANSI-C29.8	-	For wet-process porcelain insulators apparatus, post-type
ANSI-G.8	-	Iron and steel hardware
CISPR-7B	-	Recommendations of the CISPR, tolerances of form and of Position, Part 1
ASTM A-153	-	Zinc Coating (Hot-Dip) on iron and steel hardware

Strain and rigid bus-conductor

IS-2678	-	Dimensions & tolerances for Wrought Aluminum and Aluminum Alloys drawn round tube.
IS-5082	-	Wrought Aluminum and Aluminum Alloy Bars. Rods, Tubes and Sections for Electrical purposes.
ASTM-B 230-82	-	Aluminum 1350 H19 Wire for electrical purposes
ASTM-B 231-81	-	Concentric - lay - stranded, aluminum 1350 conductors
ASTM-B 221	-	Aluminum - Alloy extruded bar, road, wire, shape
ASTM-B 236-83	-	Aluminum bars for electrical purpose (Busbars)
ASTM-B 317-83	-	Aluminum-Alloy extruded bar, rod, pipe and structural shapes for electrical purposes(Bus Conductors)

Batteries and batteries charger Battery

IS:1651	-	Stationary Cells and Batteries, Lead-Acid Type (with Tubular Positive Plates)
IS:1652	-	Stationary Cells and Batteries, Lead-Acid Type (with Plante Positive Plates)
IS:1146	-	Rubber and Plastic Containers for Lead-Acid Storage Batteries
IS:6071	-	Synthetic Separators for Lead-Acid Batteries
IS:266	-	Specification for Sulphuric Acid
IS:1069	-	Specification for Water for Storage Batteries
IS:3116	-	Specification for Sealing Compound for Lead-Acid Batteries
IS:1248	-	Indicating Instruments

Battery Charger

IS:3895	-	Mono-crystalline Semiconductor Rectifier Cells and Stacks
IS:4540	-	Mono-crystalline Semiconductor Rectifier Assemblies and Equipment.
IS:6619	-	Safety Code for Semiconductor Rectifier Equipment
IS:2026	-	Power Transformers
IS:2959	-	AC Contactors for Voltages not Exceeding 1000 Volts
IS:1248	-	Indicating Instruments
IS:2208	-	HRC Fuses
IS:13947 (Part-3)	-	Air break switches, air break disconnectors & fuse combination units for voltage not exceeding 1000V AC or 1200V DC
IS:2147	-	Degree of protection provided by enclosures for low voltage switchgear and controlgear.
IS:6005	-	Code of practice for phosphating of Iron and Steel
IS:3231	-	Electrical relays for power system protection
IS:3842	-	Electrical relay for AC Systems
IS:5	-	Colours for ready mix paint
IEEE-484	-	Recommended Design for installation design and installation of large lead storage batteries for generating stations and substations.
IEEE-485	-	Sizing large lead storage batteries for generating stations and substations

Wires and cables

ASTMD-2863	-	Measuring the minimum oxygen concentration to support candle like combustion of plastics (oxygen index)
IS-694	-	PVC insulated cables for working voltages upto and including 1100 Volts.
IS-1255	-	Code of practice for installation and maintenance of power cables, upto and including 33 kV rating
IS-1554 (P1 and P2)	-	PVC insulated (heavy duty) electric cables (part 1) for working voltage upto and including 1100 V.
	-	Part (2) for working voltage from 3.3 kV upto and including 11kV.
IS:1753	-	Aluminium conductor for insulated cables
IS:2982	-	Copper Conductor in insulated cables.
IS-3961 (P1 to P5)	-	Recommended current ratings for cables.
IS-3975	-	Mild steel wires, formed wires and tapes for armouring of cables.
IS-5831	-	PVC insulating and sheath of electric cables.
IS-6380	-	Elastometric insulating and sheath of electric cables.
IS-7098	-	Cross linked polyethylene insulated PVC sheathed cables for working voltage upto and including 1100 volts.
IS-7098	-	Cross-linked polyethyle insulated PVC sheathed cables for working voltage from 3.3kV upto and including 33 kV.
IS-8130	-	Conductors for insulated electrical cables and flexible cords.
IS-1753	-	Aluminum Conductors for insulated cables.
IS-10418	-	Specification for drums for electric cables.
IEC-60096 (part 0 to p4)	-	Radio Frequency cables.
IEC-60183	-	Guide to the Selection of High Voltage Cables.
IEC-60189 (P1 to P7)	-	Low frequency cables and wires with PVC insulation and PVC sheath.
IEC-60227 (P1 to P7)	-	Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750V.
IEC-60228	-	Conductors of insulated cables
IEC-60230	-	Impulse tests on cables and their accessories.
IEC-60287 (P1 to P3)	-	alculation of the continuous current rating of cables (100% load factor).
IEC-60304	-	Standard colours for insulation for low frequency cables and wires.
IEC-60331	-	Fire resisting characteristics of Electric cables.
IEC-60332 (P1 to P3)	-	Tests on electric cables under fire conditions.
IEC-60502	-	Extruded solid dielectric insulated power cables for rated voltages from 1 kV upto to 30 kV
IEC-754 (P1 and P2)	-	Tests on gases evolved during combustion of electric cables.

AIR conditioning and ventilation

IS-659	-	Safety code for air conditioning
IS-660	-	Safety code for Mechanical Refrigeration
ARI:520	-	Standard for Positive Displacement Refrigeration Compressor and Condensing Units
IS:4503	-	Shell and tube type heat exchanger
ASHRAE-24	-	Method of testing for rating of liquid coolers
ANSI-B-31.5	-	Refrigeration Piping
IS:2062	-	Steel for general structural purposes
IS:655	-	Specification for Metal Air Dust
IS:277	-	Specification for Galvanised Steel Sheets
IS-737	-	Specification for Wrought Aluminium and Aluminium Sheet & Strip
IS-1079	-	Hot rolled cast steel sheet & strip
IS-3588	-	Specification for Electrical Axial Flow Fans
IS-2312	-	Propeller Type AC Ventilation Fans
BS-848	-	Methods of Performance Test for Fans
BS-6540 Part-I	-	Air Filters used in Air Conditioning and General Ventilation
BS-3928	-	Sodium Flame Test for Air Filters (Other than for Air Supply to I.C. Engines and Compressors)
US-PED-2098	-	Method of cold DOP & hot DOP test
MIL-STD-282	-	DOP smoke penetration method
ASHRAE-52	-	Air cleaning device used in general ventilation for removing particle matter
IS:3069	-	Glossary of Terms, Symbols and Units Relating to Thermal Insulation Materials.

IS:4671	-	Expanded Polystyrene for Thermal Insulation Purposes
IS:8183	-	Bonded Mineral Wool
IS:3346	-	Evaluation of Thermal Conductivity properties by means of guarded hot plate method
ASTM-C-591-69	-	Standard specification for rigid preformed cellular urethane thermal insulation
IS:4894	-	Centrifugal Fans
BS:848	-	Method of Performance Test for Centrifugal Fans
IS:325	-	Induction motors, three-phase
IS:4722	-	Rotating electrical machines
IS:1231	-	Three phase foot mounted Induction motors, dimensions of
IS:2233	-	Designations of types of construction and mounting arrangements of rotating electrical machines
IS:2254	-	Vertical shaft motors for pumps, dimensions of
IS:7816	-	Guide for testing insulation resistance of rotating machines
IS:4029	-	Guide for testing three phase induction motors
IS:4729	-	Rotating electrical machines, vibration of, Measurement and evaluation of
IS:469	-	Degree of protection provided by enclosures for rotating electrical machinery
IS:7572	-	Guide for testing single-phase a.c. motors
IS:2148	-	Flame proof enclosure for electrical apparatus
BS:4999 (Part-51)	-	Noise levels

Galvanizing

IS-209	-	Zinc Ingot
IS-2629	-	Recommended Practice for Hot-Dip galvanizing on iron and steel.
IS-2633	-	Methods for testing uniformity of coating of zinc coated articles.
ASTM-A123	-	Specification for zinc (Hot Galavanizing) Coatings, on products Fabricated from rolled, pressed and forged steel shapes, plates, bars and strips.
ASTM-A-121-77	-	Zinc-coated (Galvanized) steel barbed wire

Painting

IS-6005	-	Code of practice for phosphating of iron and steel.
ANSI-Z551	-	Gray finishes for industrial apparatus and equipment
SSPEC	-	Steel structure painting council

Fire protection system

Fire protection manul issued by tariff advisory committee (TAC) of India

HORIZONTAL CENTRIFUGAL PUMPS

IS:1520	-	Horizontal centrifugal pumps for clear, cold and fresh water
IS:9137	-	Code for acceptance test for centrifugal & axial pumps
IS:5120	-	Technical requirement – Roto dynamic special purpose pumps
API-610	-	Centrifugal pumps for general services
	-	Hydraulic Institutes Standards
BS:599	-	Methods of testing pumps
PTC-8.2	-	Power Test Codes - Centrifugal pumps

DIESEL ENGINES

IS:10000	-	Methods of tests for internal combustion engines
IS:10002	-	Specification for performance requirements for onstant speed mpression ignition engines for general purposes (above 20 kW)
BS:5514	-	The performance of reciprocating compression ignition (Diesel) engines, utilising liquid fuel only, for general purposes
ISO:3046	-	Reciprocating internal combustion engines performance
IS:554	-	Dimensions for pipe threads where pressure tight joints are required on threads
ASME Power Test Code	-	Internal combustion engine PTC-17
	-	Codes of Diesel Engine Manufacturer's Association, USA

PIPING VALVES & SPECIALITIES

IS:636	-	Non percolating flexible fire fighting delivery hose
IS:638	-	Sheet rubber jointing and rubber inserting jointing
IS:778	-	Gun metal gate, globe and check valves for general purpose
IS:78	-	Sluice valves for water works purposes (50 to300 mm)
IS:901	-	Couplings, double male and double female instantaneous pattern for fire fighting
IS:902	-	Suction hose couplings for fire fighting purposes
IS:903	-	Fire hose delivery couplings branch pipe nozzles and nozzle spanner
IS:1538	-	Cast iron fittings for pressure pipes for water, gas and sewage
IS:1903	-	Ball valve (horizontal plunger type) including floats for water supply purposes
IS:2062	-	SP for weldable structural steel
IS:2379	-	Colour Code for the identification of pipelines
IS:2643	-	Dimensions of pipe threads for fastening purposes
IS:2685	-	Code of Practice for selection, installation and maintenance of sluice valves
IS:2906	-	Sluice valves for water-works purposes (350to 1200 mm size)
IS:3582	-	Basket strainers for fire fighting purposes (cylindrical type)
IS:3589	-	Electrically welded steel pipes for water, gas and sewage (150 to 2000 mm nominal diameter)
IS:4038	-	Foot valves for water works purposes
IS:4927	-	Unlined flax canvas hose for fire fighting
IS:5290	-	Landing valves (internal hydrant)
IS:5312	-	Swing check type reflex (non-return) valves(Part-I)
IS:5306	-	Code of practice for fire extinguishing installations and equipment on premises
Part-I	-	Hydrant systems, hose reels and foam inlets
Part-II	-	Sprinkler systems
BS:5150	-	Specification for cast iron gate valves

MOTORS & ANNUNCIATION PANELS

IS:325	-	Three phase induction motors
IS:900	-	Code of practice for installation and maintenance of induction motors
IS:996	-	Single phase small AC and universal electric motors
IS:1231	-	Dimensions of three phase foot mounted induction motors
IS:2148	-	Flame proof enclosure of electrical apparatus
IS:2223	-	Dimensions of flange mounted AC induction motors
IS:2253	-	Designations for types of construction and mounting arrangements of rotating electrical machines
IS:2254	-	Dimensions of vertical shaft motors for pumps
IS:3202	-	Code of practice for climate proofing of electrical equipment
IS:4029	-	Guide for testing three phase induction motors
IS:4691	-	Degree of protection provided by enclosure for rotating electrical machinery
IS:472	-	Rotating electrical machines
IS:4729	-	Measurement and evaluation of vibration of rotating electrical machines
IS:5572	-	Classification of hazardous areas for electrical (Part-I) installations (Areas having gases and vapours)
IS:6362	-	Designation of methods of cooling for rotating electrical machines
IS:6381	-	Construction and testing of electrical apparatus with type of protection‘e’
IS:7816	-	Guide for testing insulation for rotating machine
IS:4064	-	Air break switches
IEC DOCUMENT 2 (Control Office) 432	-	Three Phase Induction Motor
VDE 0530 Part I/66	-	Three Phase Induction Motor
IS:9224 (Part-II)	-	HRC Fuses
IS:6875	-	Push Button and Control Switches
IS:694	-	PVC Insulated cables
IS:1248	-	Indicating instruments

IS:375	-	Auxiliary wiring & busbar markings
IS:2147	-	Degree of protection
IS:5	-	Colour Relay and timers
IS:2959	-	Contactors

PG Test Procedures

NFPA-13	-	Standard for the installation of sprinkler system.
NFPA-15	-	Standard for water spray fixed system for the fire protection
NFPA-12A	-	Standard for Halong 1301 Fire Extinguishing System.
NFPA-72E (Latest Edition)	-	Standard on Antomatic Fire Detectors Fire Protection Manual by TAC
NFPA-12	-	Standard on Carbon dioxide extinguisher systems.
IS:3034	-	Fire of industrial building: Electrical generating and distributing stations code of practice
IS:2878	-	CO2 (Carbon dioxide) Type Extinguisher
IS:2171	-	DC (Dry Chemical Powder) type
IS:940	-	Pressurised Water Type

D.G. SET

IS:10002	-	Specification for performance requirements for constant speed compression ignition (diesel engine) for general purposes
IS:10000	-	Method of tests for internal combustion engines
IS:4722	-	Rotating electrical machines-specification
IS:12063	-	Degree of protection provided by enclosures
IS:12065	-	Permissible limit of noise levels for rotating electrical machines.
	-	Indian Explosive Act 1932

Steel structures

IS-228 (1992)	-	Method of Chemical Analysis of pig iron, cast iron and plain carbon and low alloy steels.
IS-802 (P1 to 3:)	-	Code of practice for use of structural steel in overhead transmission line towers.
IS-806	-	Code of practice for use of steel tubes in general building construction
IS-808	-	Dimensions for hot rolled steel beam, column channel and angle sections.
IS-814	-	Covered electrodes for manual arc welding of carbon of carbon manganese steel.
IS-816	-	Code of Practice for use of metal arc welding for general construction in Mild steel
IS-817	-	Code of practice for training and testing of metal arc welders. Part 1: Manual Metal arc welding.
IS-875 (P1 to P4)	-	Code of practice for design loads (other than earthquake) for buildings and structures.
IS-1161	-	Steel tubes for structural purposes.
IS-1182	-	Recommended practice for radiographic examination of fusion welded butt joints in steel plates.
IS-1363 (P1 to P3)	-	Hexagonal head bolts, screws & nuts of products grade C.
IS-1364	-	Hexagon headbolts, screws and nuts of product grades A and B.
IS-1367 (P1 to P18)	-	Technical supply condition for threaded steel fasteners.
IS-1599	-	Methods for bend test.
IS-1608	-	Method for tensile testing of steel products.
IS-1893	-	Criteria for earthquake resistant design of structures.
IS-1978	-	Line Pipe.
IS-2062	-	Steel for general structural purposes.
IS-2595	-	Code of practice for Radiographic testing.
IS-3063	-	Single coil rectagular section spring washers for bolts, nuts and screws.
IS-3664	-	Code of practice for ultrasonic pulse echo testing by contact and immersion methods.
IS-7205	-	Safety code for erection of structural steel work.
IS-9595	-	Recommendations for metal arc welding of carbon and carbon

		manganese steels.
ANSI-B18.2.1	-	Inch series square and Hexagonal bolts and screws
ANSI-B18.2.2	-	Square and hexagonal nuts
ANSI-G8.14	-	Round head bolts
ASTM-A6	-	Specification for General Requirements for rolled steel plates, shapes, sheet piling and bars of structural use
ASTM-A36	-	Specifications of structural steel
ASTM-A47	-	Specification for malleable iron castings
ASTM-A143	-	Practice for safeguarding against embilement of Hot Galvanized structural steel products and procedure for detaching embrilement
ASTM-A242	-	Specification for high strength low alloy structural steel
ASTM-A283	-	Specification for low and intermediate tensile strength carbon steel plates of structural quality
ASTM-A394	-	Specification for Galvanized steel transmission tower bolts and nuts.
ASTM-441	-	Specification for High strength low alloy structural manganese vanadium steel.
ASTM-A572	-	Specification for High strength low alloy colombium- Vanadium steel of structural quality
AWS D1-0	-	Code for welding in building construction welding inspection
AWS D1-1	-	Structural welding code
AISC	-	American institute of steel construction
NEMA-CG1	-	Manufactured graphite electrodes

Piping and pressure vessels

IS-1239 (Part 1 and 2)	-	Mild steel tubes, tubulars and other wrought steel fittings
IS-3589	-	Seamless Electrically welded steel pipes for water, gas and sewage.
IS-6392	-	Steel pipe flanges
ASME	-	Boiler and pressure vessel code
ASTM-A120	-	Specification for pipe steel, black and hot dipped, zinc-coated (Galvanized) welded and seamless steel pipe for ordinary use
ASTM-A53	-	Specification for pipe, steel, black, and hotdipped, zinc coated welded and seamless
ASTM-A106	-	Seamless carbon steel pipe for high temperature service
ASTM-A284	-	Low and intermediate tensile strength carbonsilicon steel plates for machine parts and general construction.
ASTM-A234	-	Pipe fittings of wrought carbon steel and alloy steel for moderate and elevated temperatures
ASTM-S181	-	Specification for forgings, carbon steel for general purpose piping
ASTM-A105	-	Forgings, carbon steel for piping components
ASTM-A307	-	Carbon steel externally threated standard fasteners
ASTM-A193	-	Alloy steel and stainless steel bolting materials for high temperature service
ASTM-A345	-	Flat rolled electrical steel for magnetic applications
ASTM-A197	-	Cupola malleable iron
ANSI-B2.1	-	Pipe threads (Except dry seal)
ANSI-B16.1	-	Cast iron pipe flangesand glanged fitting. Class 25, 125, 250 and 800
ANSI-B16.1	-	Malleable iron threaded fittings, class 150 and 300
ANSI-B16.5	-	Pipe flanges and flanged fittings, steel nickel alloy and other special alloys
ANSI-B16.9	-	Factory-made wrought steel butt welding fittings
ANSI-B16.11	-	Forged steel fittings, socket-welding and threaded
ANSI-B16.14	-	Ferrous pipe plug, bushings and locknuts with piple threads
ANSI-B16.25	-	Butt welding ends
ANSI-B18.1.1	-	Fire hose couplings screw thread.
ANSI-B18.2.1	-	Inch series square and hexagonal bolts and screws
ANSI-B18.2.2	-	Square and hexagonal nuts
NSI-B18.21.1	-	Lock washers
ANSI-B18.21.2	-	Plain washers
ANSI-B31.1	-	Power piping
ANSI-B36.10	-	Welded and seamless wrought steel pipe
ANSI-B36.9	-	Stainless steel pipe

Other civil works standards

IS-269	-	33 grade ordinary portland cement.
IS2721	-	Galvanized steel chain link fence fabric

IS-278	-	Galvanized steel barbed wire for fencing.
IS-383	-	Coarse and fine aggregates from natural sources for concrete.
IS-432 (P1 and P2)	-	Mild steel and medium tensile steel bars and hard-dawn steel wire for concrete reinforcement.
IS-456	-	Code of practice for plain and reinforced concrete.
IS-516	-	Method of test for strength of concrete.
IS-800	-	Code of practice for general construction in steel.
IS-806	-	Steel tubes for structural purposes.
IS-1172	-	Basic requirements for water supply, drainage and sanitation.
IS-1199	-	Methods of sampling and analysis of concrete.
IS-1566	-	Hard-dawn steel wire fabric for concrete reinforcement.
IS-1742	-	Code of Practice for Building drainage.
IS-1785	-	Plain hard-drawn steel wire for prestressed concrete.
IS-1786	-	High strength deformed Steel Bars and wires for concrete reinforcement.
IS-1811	-	Methods of sampling Foundry sands.
IS-1893	-	Criteria for earthquake resistant design of structures.
IS-2062	-	Steel for general structural purposes.
IS-2064	-	Selection, installation and maintenance of sanitary appliances- code of practices.
IS-2065	-	Code of practice for water supply in buildings.
IS-2090	-	High tension steel bars used in prestressed concrete.
IS-2140	-	Standard Galvanized steel wire for fencing.
IS-2470 (P1 & P2)	-	Code of practice for installation of septic tanks.
IS-2514	-	Concrete vibrating tables.
IS-2645	-	Integral cement waterproofing compounds.
IS-3025 (Part 1 to Part 48)	-	Methods of sampling and test (Physical and chemical) for water and waste water.
IS-4091	-	Code of practice for design and construction of foundations for transmission line towers and poles.
IS-4111 (Part 1 to P5)	-	Code of practice for ancillary structures in sewerage system.
IS-4990	-	Plywood for concrete shuttering work.
IS-5600	-	Sewage and drainage pumps.

National building code of India 1970

USBR E12	-	Earth Manual by United States Department of the interior Bureau of Reclamation
ASTM-A392-81	-	Zinc/Coated steel chain link fence fabric
ASTM-D1557-80	-	test for moisture-density relation of soils using 10-lb (4.5 kg) rame land 18-in. (457 mm) Drop.
ASTM-D1586	-	Penetration Test and Split-Barrel (1967) - Sampling of Soils
ASTM-D2049-69	-	Test Method for Relative Density of Cohesionless Soils
ASTM-D2435	-	Test method for Unconsolidated, (1982)
	-	Undrained Strengths of Cohesive Soils in Triaxial Compression.
BS-5075	-	Specification for accelerating Part I Admixtures, Retarding Admixtures and Water Reducing Admixtures.
CPWD	-	Latest CPWD specifications

ACSR MOOSE CONDUCTOR

IS:6745	Methods for Determination of BS:443-1969 Mass of zinc coating on zinc coated Iron and Steel Articles
IS:8263	Methods for Radio Interference IEC:437-1973Test on High Voltage Insulators NEMA:107-1964 CISPR
IS:209	Zinc Ingot BS:3436-1961
IS:398	Aluminum Conductors for IEC:209-1966
Part – V	Overhead Transmission Purposes
BS:215(Part-II)	Aluminium Conductors galvanized IEC:209- forced extra high

BS:215(Part-II)	voltage (400 kV and above)
IS:1778	Reels and Drums forBS:1559-1949 Bare Conductors
IS:1521	Method for Tensile Testing ISO/R89-1959 of steel wire
IS:2629	Recommended practice for Hot dip Galvanising on Iro and Steel.
IS:2633	Method for Testing Uniformity of coating of zinc Coated Articles.
IS:4826	Hot dip galvanised coatings on round steel wires ASTMA-472-729

GALVANISED STEEL EARTHWIRE

IS:1521	Method for Tensile Testing ISO/R:89-1959 of Steel Wire
IS:1778	Reels and Drums for Bare Conductors
IS:2629	Recommended practice forHot Dip Galvanising on Ironand Steel.
IS:2633	Methods for testing Uniformityof Coating of Zinc Coated Articles.
IS:4826	Hot dip Galvanised Coatings ASTM:A 475-72 a on Round Steel Wires BS:443-1969
IS:6745	Method for Determination BS:443-1969of mass of Zinc Coating on Zinc coated Iron and Steel Articles.
IS:209	Zinc ingot BS:3463-1961
IS:398(Pt. I to P5:1992)	Aluminum Conductors for BS:215 (Part-II) overhead transmission purposes.

Lighting Fixtures and Accessories

(i)	IS:1913	General and safety requirements for electric lighting fittings.
(ii)	IS:3528	Water proof electric lighting fittings.
(iii)	IS:4012	Dust proof electric lighting fittings.
(iv)	IS:4013	Dust tight proof electric lighting fittings.
(v)	IS:10322	Industrial lighting fittings with metal reflectors.
(vi)	IS:10322	Industrial lighting fittings with plastic reflectors.
(vii)	IS:2206	Well glass lighting fittings for use under ground in mines (non-flameproof type).
(viii)	IS:10322	Specification for flood light.
(ix)	IS:10322	Specification for decorative lighting outfits.
(x)	IS:10322	Lumanaries for street lighting
(xi)	IS:2418	Tubular flourescent lamps
(xii)	IS:9900	High pressure mercury vapour lamps.
(xiii)	IS:1258	Specification for Bayonet lamp flourescent lamp.
(xiv)	IS:3323	Bi-pin lamp holder tubular flourescent lamps.
(xv)	IS:1534 (Part-I)	Ballasts for use in flourescent lighting fittings.
(xvi)	IS:1569	Capacitors for use in fluorescent lighting fittings
(xvii)	IS:2215	Starters for flourescent lamps.
(xviii)	IS:3324	Holders for starters for tubular flourescent lamps
(xix)	IS:418	GLS lamps
(xx)	IS:3553	Water tight electric fittings
(xxi)	IS:2713	Tubular steel poles
(xxii)	IS:280	MS wire for general engg. purposes

Conduits, Accessories and Junction Boxes

(1)	IS:9537	Rigid steel conduits for electrical wiring
(2)	IS:3480	Flexible steel conduits for electrical wiring
(3)	IS:2667	Fittings for rigid steel conduits for electrical wiring
(4)	IS:3837	Accessories for rigid steel conduits for electrical wiring
(5)	IS:4649	Adaptors for flexible steel conduits.
(6)	IS:5133	Steel and Cast Iron Boxes
(7)	IS:2629	Hot dip galvanising of Iron & Steel.

Lighting Panels

(1)	IS:13947	LV Switchgear and Control gear(Part 1to 5)
(2)	IS:8828	Circuit breakers for over current protection for house hold and similar installations.
(3)	IS:5	Ready mix paints
(4)	IS:2551	Danger notice plates
(5)	IS:2705	Current transformers
(6)	IS:9224 650V(Part-2)	HRC Cartridge fuse links for voltage above
(7)	IS:5082	Wrought aluminium and Al. alloys, bars, rods, tubes and sections for electrical purposes.
(8)	IS:8623	Factory built Assemblies of Switchgear and Control Gear for voltages upto and including 1000V AC and 1200V DC.
(9)	IS:1248	Direct Acting electrical indicating instrument

Electrical Installation

(1) IS:1293	3 pin plug
(2) IS:371	Two to three ceiling roses
(3) IS:3854	Switches for domestic and similar purposes
(4) IS:5216	Guide for safety procedures and practices in electrical work.
(5) IS:732	Code of practice for electrical wiring installation (system voltage not exceeding 650 Volts.)
(6) IS:3043	Code of practice for earthing.
(7) IS:3646	Code of practice of interior illumination part II & III.
(8) IS:1944	Code of practice for lighting of public through fares.
(9) IS:5571	Guide for selection of electrical equipment for hazardous areas.
(10) IS:800	Code of practice for use of structural steel in general building construction.
(11) IS:2633	Methods of Testing uniformity of coating on zinc coated articles.
(12) IS:6005	Code of practice for phosphating iron and steel.
(13)	INDIAN ELECTRICITY ACT
(14)	INDIAN ELECTRICITY RULES

LT SWITCHGEAR

IS:8623 (Part-I)	Specification for low voltage switchgear and control gear assemblies
IS:13947 (Part-I)	Specification for low voltage switchgear and control gear, Part 1 General Rules
IS:13947 (part-2)	Specification for low voltage switchgear and control gear, Part 2 circuit breakers.
IS:13947 (part-3)	Specification for low voltage switchgear and control gear. Part 3 Switches, Disconnectors, Switch-disconnectors and fuse combination units
IS:13947 (part-4)	Specification for low voltage switchgear and control Gear. Part 4 Contactors and motors starters.
IS:13947 (part-5)	Specification for low voltage switchgear and control gear. Part 5 Control-circuit devices and switching elements
IS:13947 (part-6)	Specification for low voltage switchgear and control gear. Part 6 Multiple function switching devices.
IS:13947 (part-7)	Specification for low voltage switchgear and control gear. Part 7 Ancillary equipments
IS:12063	Degree of protection provided by enclosures
IS:2705	Current Transformers
IS:3156	Voltage Transformers

IS:3231	Electrical relays for power system protection
IS:1248	Electrical indicating instruments
IS:722 AC	Electricity meters
IS:5578	Guide for Marking of insulated conductors of apparatus terminals
IS:13703 (part 1)	Low voltage fuses for voltage not exceeding 1000V AC or 1500V DC Part 1 General Requirements
IS:13703 (part 2)	Low voltage fuses for voltage not exceeding 1000V AC or 1500V DC Part 2 Fuses for use of authorized persons
IS:6005	Code of practice of phosphating iron and steel
IS:5082	Wrought Aluminum and Aluminum alloys for electrical purposes
IS:2633	Hot dip galvanising

ANNEXURE – D

LIST OF DRAWINGS/DOCUMENTS

1. Single Line Diagram
2. Electrical Layout – Plan and Sections
3. Switchyard structural Layout and Section
4. DSLP Calculation and drawing
5. Earthmat Design
6. Short circuit Force and Critical Span Calculations
7. Busbar Design calculations
8. Cantilever Strength calculations
9. Design calculation for Sag – Tension stringing chart
10. GTP and drawings for Bus-Post Insulator
11. Tension/suspension string insulator and Hardware Assembly GTP and drawing
12. Structure Layout (Plan & Section) drawing
13. Soil Investigation Report

14. **Circuit Breakers (220kV and 33kV)**
    - GA drawing
    - GTP
    - Type test Reports
15. **CTs (220kV and 33kV)**
    - GA drawing
    - GTP
    - Type test Reports
16. **Surge Arrestors (216kV and 30kV)**
    - GA drawing
    - GTP
    - Type test Reports
17. **Isolators (220kV and 33kV)**
    - GA drawing
    - GTP
    - Type test Reports
18. **220kV Transformers (220/33/11kV)**
    - Outline GA drawings
    - Foundation Plan
    - Data Sheet
    - OLTC GA drawing/schematic
    - RTCC GA drawing/schematic
    - OGA and Data sheets for Bushing
    - GA and schematic of Marshalling Kiosk
    - Rating and Diagram Plate
    - Type test Reports
19. **Control and Relay Panels**
    - GTP and technical literature
    - Type test report of Relays/Relays/Equipments
20. **Civil Works**

    Boundary wall

    Control Room Building
    - Structure Design, Foundation Design & Drg., Plinth Beam Design & Drg. and column Design & Drg. upto G.F. Level
    - Transformer foundation design/drawings
    - 220kV Tower foundation design/drawings.

SECTION-IV

SPECIAL EQUIPMENTS

SECTION : 4

SPECIAL EQUIPMENTS

TECHNICAL SPECIFICATION FOR SPECIAL EQUIPMENTS

This part of the document covers detailed technical requirement for the diagnostic tools complete with associated components and accessories including required software for storage of data and interpretation of results etc.

(i) DEW POINT METER.

The meter shall be capable of measuring the dew point of SF6 gas of the circuit breaker/GIS equipment. It should be portable and adequately protected for outdoor use. The meter shall be provided with dew point hygrometer with digital indication to display the dew point temperature in degree C, degree F or PPM. It should be capable of measuring the corresponding pressure at which dew point is being measured.

The measurement and use of the instrument must be simple, direct without the use of any other material /chemical like dry ice/acetone etc. It should be battery operated with rechargeable batteries.

TECHNICAL SPECIFICATION:

1. Measuring Range: Upto-100 º C dew point.
2. Accuracy : ± 2 º C.
3. Display : 4 digit LCD , 0.5 inch high.

(ii) PORTABLE PD MONITORING SYSTEM FOR GAS INSULATED SWITCHGEAR

DELETED

(iii) THREE PHASE AUTOMATION RELAY TEST KIT.

The test kit/set should be capable of performing the following functions in automatic as well as in manual mode.

1. "Steady state" testing of current, voltage, frequency and impedance relays to test the characteristic of protective relays.
2. Testing of over fluxing relay and check synchronizing relay.
3. Testing of electro-mechanical backup over-current relays for operating current upto 2x, 5x and 10x rated current (minimum pickup instantaneous and time delayed characteristics).
4. Testing of frequency relays for rate of change of frequency, minimum pickup, pickup to drop out ratio, under/over frequency setting and time characteristics.
5. Testing of distance relays of three phase including features such as power swing blocking, switch on to fault and when connected to weak system.
6. Testing of voltage relay for pickup to drop out ratio, instantaneous and time delayed characteristics.
7. Testing of three winding differential relays (9 current sources) including checking of Percentage Bias, Inrush stability, Over excitation stability.
8. Programmable Relay test kit should work as—
   i) Relay test tool for all type of relays mentioned.
   ii) "Database" to document relay settings.
   iii) Storage of test history.
9. Software programme should be menu driven and should run on Microsoft Windows(98, NT.2000 or latest version).
10. The test programme/plan should allow user to define the control parameters to control changes to magnitude, phase and frequency of selected source values and allow user to :
    i) Ramp up/down (at user defined rates) to test the pick up/ dropout values.

ii) Step up/step down the magnitude, phase angle of frequency.
iii) Quickly find the pick up value.
iv) Test the characteristic angle for impendence relays/ directional relays.

11. The programmable/automatic Relay test kit should be capable of doing simulation of power system states like pre-fault, fault and post fault conditions for dynamic state testing.
12. Test program/plan should enable user of creating a number of system states to test protection scheme/relay for realistic fault conditions and should be capable to calculation voltage and current phasors during fault conditions.
13. Suitable ANSI-SQL 92 complaint RDBMS Database system to allow user to store historical test parameters and rest result.
14. For observing the performance of distance relay under various grid conditions. The transient and Dynamic testing shall be possible.
15. Reply of Distance recorder output through COMTRADE format should be possible.
16. Through Report generation software, it shall be possible to compare previous test result and deviations can be brought out with permissible tolerance in the report.
17. Through test set –
    It shall be possible to generate conditions such as breaker failure. Carrier fail etc.
18. Test kit shall have provision to carryout end test using GPS receivers available at both local and remote S/tn.

Features of Software :
Licensed, latest version of automatic testing software certified by manufacturer only to be supplied to DTL. It shall be WINDOW based and can be customized by user without knowledge of programming language. All operation using software shall be through user friendly GUI (Graphical User Interface). Calibration Software & Hardware to be supplied to DTL.

Out Put Requirements :

(i) Voltage Output	: 3 phase, 0-300 V per phase, accuracy : 0.1% or better
(ii) Current Output	: 3 phase, 10 amps per phase, 400 VA at 40 Volts. Accuracy : 0.1 or better
(iii) Phase angle	: 0 to 360 degrees.
(iv) Frequency	: DC to 200 Hz.

Other Essential Requirements :
(i) Equipment shall be capable of upgrading to latest version manufactured for next 5 Years.
(ii) An adequate calibration box provided to calibrate the current and voltage of the test kit. This should be apart from the software calibration.

(iv) CONTACT RESISTANCE METER

General
The equipment shall measure and display the static contact resistance of circuit breaker, isolator, bus bar joints and earth switches etc: directly in micro-ohms under live switchyard conditions.

Technical Specification
Ranges: 1999.9 micro ohm, 1999 micro ohm and 19.99m. ohm.
Resolution: 0.1 micro ohm, 1 ohm, and 10 micro ohm.
Respectively.
Accuracy: Value : ±1% : ± 2 digits.
Current : 200 ADC,
Display : Two,3½ digit ½ inch LCD, for current and resistance Values.
Power : 220 VAC ± 10% 50 Hz ± 5%, 30VA
Battery : Instrument operation on input rechargeable battery (12 V, 7 AH Maintenance free).

(v) CIRCUIT BREAKER OPERATIONAL ANALYSER

CIRCUIT BREAKER OPERATIONAL ANALYSER WITH DCRM

1.0 General:

1.1 This instrument shall be used for testing functioning of EHV circuit breakers in live/charged switchyards.

1.2 The operation analyzer should be able to measure, record and print graphically the operation timings, mechanism travel and velocity, trip and close coil current rise and fall, dynamic contact resistance (DCRM) and functioning of auxiliary contacts of CB.

1.3 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version.

1.4 The kit and accessories shall be robust, rugged enough and easily portable so that it can be transported safely to different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit. Further, the instrument shall be robust enough to sustain the jerks during the transportation in local condition.

1.5 The bidder will have to demonstrate the kit for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site upto the satisfaction of DTL at their own cost and this will be the part of technical evaluation. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

1.6 The kit should be capable of operating and storing data at temperature from 0 degree C to 50 degree C and humidity up to 90%.

2.0 Functional Requirement:

2.1 The Computer Aided CB Analyzer system comprising of CB operation unit, programme unit, travel analyzer unit & analysis software should be capable to perform close, open ,close-open, open-close, open-close, open operation on CB under test, with a facility to introduce time delays between composite operation.

2.2 The instrument should be suitable for measuring the Operation timing of main and auxiliary contacts (wet &dry) as well as coil currents.

2.3 The CB Analyzer should be able to measure and record current rise and fall of tripping coils as well as of closing coils for at least two breaks of Circuit Breaker poles simultaneously.

2.4 It should measure the Dynamic Contact Resistance of main & arcing contacts as well as travel measurement (with external travel transducer) of operating mechanism.

2.5 The instrument should be suitable for testing the CBs up to 400 kV as per applicable standards and testing procedure of DTL.

2.6 The test results should have repeatability, consistency & Immunity to electromagnetic interference in live switchyard upto 400 kV levels.

2.7 The CB Analyzer should be capable to measure pole discrepancy timing.

2.8 The CB Analyzer should be capable to calculate and print all contact closing & opening tuning in tabular form also.

3.0 Technical Parameters:

S. No	Description			
1.	Functional Requirement The operation analyzer must have availability of minimum no. of following channels:		The operation analyzer must have availability of minimum no. of following channels:	
			400kV	220kV
		1.	Main Contact Channels:6 (2 per pole on 3 pole simultaneously)	Main Contact Channels:3 (1 per pole on 3 pole simultaneously)
		2	DCRM/Test Current Channels:6	DCRM/Test Current Channels:3
		3	Travel Channel:03	Travel Channel:03
		4	Coil Current Channel:06	Coil Current Channel:06
		5	Aux. Contact Channel:06	Aux. Contact Channel:06
2.	Sampling Speed	≥20 kHz		
3.	Accuracy	1.	Timing : ± 1 % of reading	
		2.	Coil Current: ± 1 % of reading	
		3.	R : ± 2 % of reading	
		4.	Travel: ± 1 % of reading	
4.	Measurement Range:	1.	Timing: 0-4 s	
		2.	R: 0-8 m Ω.	
		3.	Coil Current:0-25 A	
5.	Resolution	Timing: 0.1 ms		
6.	DCRM Test Current	100 Amp (Minimum)		
7.	PC Interface	It shall include supply of one laptop PC of Dell/Lenovo/HP make with latest specifications such as Core i5 Intel Processor,4GB RAM, 320GB or better HDD, 15'' TFT screen, Combo 24xCD R/W Drive ie having CD read / write facility complete with required cables and connectors with preloaded operating MS Window 7 professional or better with latest version application software require for storage analysis and record management.		
8.	Power Supply	It shall work on single phase 230 Volts ±10 %, 50 Hz ±5 % supply with standard socket.		
9.	Operating Temperature	0 to +50 deg C		
10.	Relative humidity	Max. 90% non-condensing.		
11.	Environment	The test kit shall be compatible for EMI/EMC/Safey		

		environment.

4.0 System Operation hardware/software, peripherals and analysis software for CB Analyzer

4.1 The test report for recording motion should provide test results both in form of curve and tables. The tables should consist of calculated CB parameters such as closing/opening speed etc.

4.2 The entry of various data/parameters (pertaining to CB) be possible built in display of menu.

4.3 The battery backup and real time clock should be provided for automatic date and time functions.

4.4 The analyzer should be capable to record transient phenomenon for duration at least 500 ms.

4.5 The binary channel accuracy and analogue channel accuracy should be suitable meet all desired functions (stated above).

4.6 The CB analyzer should be provided with facility of down loading data to PC.

4.7 The printer provided with CB analyzer should be preferably a plain paper printer.

4.8 The computer aided CB analysis software should be supported with suitable report generation.

4.9 It should be possible to change scale factor of time axis to enable enlarged view of part of diagram.

4.10 It should be possible to change amplitude scale to make best use of available space.

4.11 It should be possible to study on speed curve, the damping and speed variations at CB opening and closing time.

4.12 The CB analyzer should be supplied with portable memory bank to store test result taken by test kit to enable further down loading to centrally located PC.

4.13 Window based PC down loading software should be provided with CB analyzer to facilities downloading test result from memory bank to PC where it can be analyzed and stored in proper directory/file.

4.14 It should be possible to compare present results with previous one. The feature of Zooming the graph and moving the cursors on graph, thereby indicating instantaneous values of test parameters should also be provided.

4.15 The latest version of CB analyzer system (hardwares and softwares) to be supplied and time to time updating of software should be offered.

4.16 As and when required, technical support for analysis of critical test result to be offered, on regular basis.

4.17 The software should be suitable for automatic testing & report generation, signature as well as trend analysis. The kit should have facility to store and communicate with windows based computer for exporting the test data.

5.0 Other Essential Requirements.

5.1 Protection/ Control

Against short circuit, over voltage, improper ground connection, over load & transient surges, the kit should have alarm/cut-off features to protect the instrument. Also the kit should have facility of stopping automatically on power failure.

5.2 Cooling Arrangement

Necessary in built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/ accessory shall have to be required.

5.3 Test Leads and accessories

One complete set of cables of sufficient length (min 20metre) with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test in DTL S/Stn. Additionally all the required accessories should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.

5.4 Travel Transducers

One set of travel transducers along with clamp/fixtures to suit 400/220 kV CBs of ABB/AREVA/ALSTOM/BHEL/CGL/ SIEMENS etc (wherever applicable) make for AIS and for GIS Stations, CB details shall be provided by DTL and the supplier shall have to develop & supply the transducers within delivery schedule. The voltage class and make shall be intimated along with the order.

5.5 Calibration Certificate

Unit shall be duly calibrated before supply and the date of calibration shall not be older than two month from the date of supply of Kit.

5.6 Training

Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to DTL engineers, where kit is being supplied.

5.7 Weight

It should be portable and trolley mounted for smooth movement in live switchyard.

GUARANTEED TECHNICAL PARTICULARS FOR CIRCUIT BREAKER OPERATION ANALYSER WITH DCRM

(To be filled in and signed by the Bidder)

1.	Name of manufacturer		
2.	Type and Model		
3.	Applicable standards		
4.	Logic		
5.	Maximum Configuration		
6.	Time measurement		
	(i)Range		
	(ii)Resolution		
	(iii)Accuracy		
7.	No. of current channels		
8.	No. of travel channels		
9.	Binary channels		
10.	Sampling speed		
11.	Plot length		
12.	Printer		
13.	Paper type		
14.	Display of test results		
15.	Test leads		
	(i)	Type of leads	
	(ii)	No. of leads	
	(iii)	Length	
16.	Power supply		
17.	Weight		
18.	Details o f type tests		
19.	No. of cases		
20.	Case type & size		
21.	Transducer (i) Voltage (ii) Speed.		
22.	Particulars of Dynamic contact resistance		
	(i)	Working current	
	(ii)	Range Full scale	
	(iii)	Operation • Battery • Mains	
	(iv)	Resolution • Minimum • Maximum	
	(iv) Accuracy		
23.	Environmental/service conditions :		

(vi) SF6 Gas leak Detector

Technical Specifications for SF6 Gas Leak Detector Equipment along with Standard Accessories:

1. General Requirements

1.1 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version.

1.2 The instrument should have been proven for repeatability of test result in charged switchyard of EHV substations. Documentary evidence for this should be furnished along with the bid.

1.3 The acceptance of the equipment is subject to the successful demonstration to the satisfaction of DTL at prescribed site of DTL including 400KV switchyard/site during technical evaluation.

1.4 Under very high/low ambient temperatures, high humidity, equipment shall be able to carry out measurement under these conditions.

2. Functional Requirement:

2.1. The meter shall be capable of detecting leakage of SF6 from 400/220kV Circuit Breakers/GIS equipments. Instrument shall work in induced condition of charged switchyard up to 400kV level. The equipment shall not be sensitive to moisture or other gases in atmosphere and water vapour.

2.2. It shall be Microprocessor controlled, with advanced digital signal processing, visual LED display Audible signal for progressive leak-size indication having following features:

a. easy and tactile keypad control, battery test function, battery low voltage indication etc;
b. Cordless and portable, Battery operated,
c. Immediate response time for quick leak detection and quick return to zero - position even after detection of large leaks.
d. The sensing probe shall be such that it can reach all the points on the switchgear where leakage is to be sensed.

2.3. The equipment and accessories shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation case and packing of the equipment shall be such that the transportation from one station to other will not affect the performance, repeatability and accuracy of measurement of equipment.

2.4. The test results should have repeatability consistency & immunity to electromagnetic, electrostatic interference in live switch yard up to 400kV.

2.5. Safety, EMC/EMI, Environment, Enclosure, and Interference limit shall be as per national/international standards with latest revision.

2.6. Accessories:

Set of batteries, Battery Charger, Manual, Hard Carrying case, Spare sensor tip etc, Software CD and other mandatory accessory.

SPARES: Filter Tips 5 nos, Infra red cell or any other consumable as required/Mandatory for operations of kit during guarantee period, Optional spares shall be quoted separately.

3. Technical Parameters:-

S.No.	Parameter	Specification
1.	Method of operation and principle	Continuous leak detection and leak measurement operation during leak check without limitation with audible and visual indication.(Infrared technology)
2.	Range of SF6 leak measurement during leak detection	0-1000 and more PPMv by volume with accuracy of ±5% or better
3.	Sensitivity	3.5 gm SF6/year or less. No cross sensitive to other gases
4.	Response Time	Immediately
5.	Alarm	Visual as well as Audio
6.	Power supply	Li-Ion batteries powered / equivalent power supply with charger.
7.	Batteries voltage indication/test function	To be displayed
8.	Spares	Mandatory for operation of equipment during guarantee period
9.	Operating Temperature & Relative Humidity	0 to 50°C & RH 95%

4. Calibration certificate:-

The instrument shall be supplied with proper Calibration certificate from NABL or internationally accredited lab. It is the responsibility of the supplier to provide the Calibration services of the instrument after the calibration interval is over. Date of Calibration Certificate shall not be older than three month from the date of supply of kit.

5. Demonstration:-

The bidder will have to demonstrate the equipment for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site up to the satisfaction of DTL at their own cost and **this will be the part of technical evaluation**. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

6. Warranty/Guarantee Period:

Min 05 years from the date of successful & complete commissioning at DTL sub-station.
The warranty shall include:
a) Calibration of instrument (annually),
b) As much as visit for repairs to site, along with all the materials, including accessories etc. are to be covered under warranty/guaranty period. If the equipment needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of equipment for repair at test lab / works.

7. Services after sale:

Bidder will have to submit the documentary evidences of having established mechanism for prompt services as and when required by DTL. Bidder need to submit their organization service chart along with bid.

8. Commissioning, Training and Handling Over of the Instrument

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demo shall be rejected and no repairs are allowed.

Bidder will have to provide training to DTL engineers for safe operation and maintenance of the instrument before handing over the same at DTL site in batches."

9. Guaranteed technical particulars SF6 Gas Leak Detector Test Equipment along with Standard Accessories

Sr.No	Item	Description (To be filled in and signed by the Bidder)
1.	Mfg.Name/Model No.	
2.	Method of Operation and principle	
3.	Range of Sf6 leak measurement during leak detection	
4.	Sensitivity	
5.	Response Time	
6.	Alarm	
7.	Power Supply	
8.	Spares	
9.	Operating temperature	
10.	Accessories	
11.	Warranty	
12.	Calibration certificate	
13.	Services after Sale	
14.	Safety, EMC/EMI, Environment, Enclosure, and Interference applicable standards	

(vii) Automatic Primary Current Injection Test Kit.

Functional specification:

The instrument should be capable of injecting single phase 50 HZ AC high value current for testing of EHV equipments like current transformers in 400kV live switchyard required to simplify comprehensive testing and condition assessment of EHV CT and its commissioning, and to test turns ratio of current transformer for that require high variable currents along with polarity test.

Technical specification:

1. Test set Input power supply should be 230Volts ±10% AC, 50Hz ± 5% Hz.
2. Output current range 0-2000A up to 20 sec.
3. The combined weight of Main unit and Current Amplifier or Booster if any should be of maximum 70 Kg.

4. Test set should be microprocessor controlled, self-contained digital, modular in design and portable. Test set should be current pre-set using low current to prevent test sample heating.
5. The Output of the test should be variable in a smooth, continuous break-less manner.
6. The control and current injection test set has to be modular design for user configuration of current module selection. There shall be continuous current control by variable auto transformer with resolution of 1A.
7. There shall be current measurement by of accuracy better than 1%.
8. Test set should be of extremely rugged construction suitable for use in 400/220/66/33kV substations, the kit should be mounted on castor wheels with necessary transport packing arrangement for easy movement.
9. Tests can be performed from a distance of 10 meters and it should be suitable up-to 400 kV Current transformers. The bidder should provide standard accessories including Cu cable set, clamps, connectors, spare fuses, indication lamps, power supply cable, etc all that is required for carrying out measurement for one unit.

10. Test set control unit display should be LED/LCD, display should provide time, Current, voltage, current input value and phase angle and should be cable of scroll through entities like Z, P, Q, R, X, S, power factor (Cos φ) and I max.

11. Test set should have automatic injection stop generation or should stop after a user specified interval or when condition at the input is met.
12. Test set should be certified on the following Environment standard with CE marking.
    a. LVD low voltage directive 2006/95/IEC.
    b. EMC directive 2004/108/EC.
    c. Safety should conform to IEC 61010-1with latest amendments
13. Test set should proper function high voltage substations and industrial environment with, operating temperature range 0^{o} C to 50^{o} C storage temp 0^{o}C to $+55^{o}$C and Humidity 5% to 95%RH, no condensing.
14. Test set should be Thermal cut off protection built in during output current generation and primary side protected by a miniature circuit breaker with over current, earth fault and short circuit protection.
15. The copper cable shall be of suitable size along with standard clamp arrangement to deliver the current of 2000A for 20 sec safely without heating/damage the testing kit.
16. The bidder should have suitable facilities for prompt repair, calibration and servicing equipment in India.
17. The bidder shall have to ensure kit is made user friendly for all the CTs available in Delhi Transco Limited. The bidder shall have to arrange necessary training to engineers of DTL.
18. Calibration certificate:-
    Kit should have automatic self calibration feature. However supplier will have to submit the calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab shall be submitted. Data of calibration shall not be older than two months from the date of supply of kit.
19. Testing standards as per IEC 60044-1, IEC 61869-2 and ANSI C57.13.
20. The test records/reports shall be able to download to a PC in Windows Excel/equivalent format. CT test equipment shall be operated through external laptop/PC also.
21. Primary injection kit should display automatic assessment of the test result as per the relevant standard; the deviating results should be highlighted.

22. Safety functions such as ground connection checks, self diagnostics, overload, over current and over temperature management.
23. The equipment should be capable of storing at least 10 test results and kit should be able to upload stored test results through External laptop through USB/RS232/Ethernet port communication.
24. The test kit should be portable on wheels. It should be easily movable/Transportable to other locations.
25. All inputs are equipped with overvoltage and surges protection devices.
26. Kit shall be warrantee for minimum 5(five) years from the date of supply. If the kit needs to be shifted to supplier's works for repairs, supplier will have to bear the cost of spares, transportation, transit insurance (to & fro) etc. of kit for repair at test lab/works. Kit after repairs, need to be returned within thirty days from the date of dispatch..
27. The bidder offering such Primary Current Injection Test Kit shall be required to demonstrate the functionality of the offered Test Kit at any of the substations in DTL. Only upon successful demonstration of the Primary Current Injection Test Kit so offered model shall be considered for Technical evaluation before opening of price bid. The supplier shall have to ensure the kit made user friendly easily movable/transportable at other locations. The instrument failed during the demonstration shall be rejected and no repairs are allowed.

28. **GUARANTEED TECHNICAL PARTICULARS (G.T.P.) Of 2000 Amp. Primary AC Injection Set.**

Sr. No.	Description	To be Filled by BIDDER
1.	Name of manufacturer	
2.	Type & Model	
3.	Input Supply (A.C.)	
4.	Maximum Output current	
5.	Current Ranges	
6.	Duty Cycle	
7.	Cooling	
8.	Current Control	
9.	Movability	
10.	Protection	
11.	Housing	
12.	Weight (Kg)	
13.	Indications	
14.	Display(LCD/LED)	
15.	Environment i)Temperature ii)Humidity	
16.	Standard Lead Sizes (Copper)	
17	Standard accessories including Cu cable set, clamps, connectors, spare fuses, indication lamps, power supply cable, etc all that is required for carrying out measurement for one unit.	
17.	Input/Binary input maximum voltage	
18.	IS/IEC Marking and Safety Standards	
19	Calibration certificate/Reports	
20	Warranty period	

21.	Whether the primary Injection set is free from Electrostatic and Electromagnetic induction prevalent in switchyard up to 400 KV?	
22.	Whether the primary Injection set is suitable for testing polarity of CT"s	
23.	Whether the primary Injection set has a USB/RS232/Ethernet port for communication with PC?	
24.	Whether the primary Injection set has provision to stop Injection automatically after user defined interval or when condition at input is met?	
25.	Whether the primary Injection set has Internal memory to save/recall test results? Specify storage capacity	
26	The test records/reports shall be able to download to a PC in Windows Excel/equivalent format. CT test equipment shall be operated through external laptop/PC also.	

(viii) Automatic capacitance and tan delta measurement kit, 10 kV

Technical Specification of Fully Automatic Capacitance and Tan Delta Kit

1. General Requirements

1.7 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version.

1.8 Kit should be able to measure capacitance and tan delta/ power factor automatic without balancing any decade and also interference suppression shall be automatic.

1.9 The instrument should have been proven for repeatability of test result in charged switchyard of EHV substations. Documentary evidence for this should be furnished along with the bid.

1.10 The kit and accessories shall be robust, rugged enough and easily portable so that it can be transported safely to different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit. Further, the instrument shall be robust enough to sustain the jerks during the transportation in local condition

1.11 The acceptance of the kit is subject to the successful demonstration to the satisfaction of DTL at prescribed site of DTL including 400KV switchyard/site during technical evaluation.

1.12 Bidder will have to submit the documentary evidences of having established mechanism for prompt services in India as and when required by DTL. Bidder need to submit their organization service chart along with bid.

1.13 The kit should be capable of operating and storing data at temperature from 0 degree C to 50 degree C and humidity up to 90%.

2. Functional Requirements

2.1 The instrument shall be suitable for automatic offline measurement of Capacitance and Tan delta of EHV class transformers (1/2/3 winding), Bushings, CTs, Bus & Line CVTs and Grading Capacitors of CB's as well as excitation current of transformer/reactor at site in charged switchyard up to 400 kV AC.

2.2 The test results should have repeatability consistency & immunity to electromagnetic, electrostatic interference in live switch yard up to 400kV.

2.3 The kit shall be capable of measuring capacitance and tan-delta of each winding up to 500 MVA transformers in suitable switching mode so that capacitance of other winding does not affect the reading etc.

2.4 The test voltage should be independent of input voltage & frequency so that no variation in frequency is there during testing.

2.5 The test kit should be capable of performing tests on all ungrounded and grounded specimens in various modes such as UST, GST-g, GST without changing the leads always.

2.6 The kit shall be capable of measuring excitation current of transformer winding at 10 kV. The kit shall be able to measure the ambient temperature and relative humidity with inbuilt/external arrangement.

2.7 The optional arrangements, if available, for measurement of inductance, transformer turns-ratio, transformer leakage reactance and loss etc, may be included in the offer. However, the tech/financial evaluation will be made for the basic kit, which have the facility of measurement of tan-delta and capacitance with induction suppression feature as detailed above.

2.8 Display should be LCD/LED (readable in sunlight), Front Panel/ Key Pad mounted on Control unit (with built-in microprocessor/computer) and providing external industrial grade Laptop PC preloaded with application software of reputed brand with latest specifications such as Intel core i5, 4GB RAM, 500 GB or higher HDD, Integrated Graphics & Audio, DVD-RW Drive, 13 inch Display, Touch pad,Wifi-802.11 a/b/g, 1gbps NIC, Bluetooth, 1xVGA, windows-7 professional or higher version latest with antivirus, Original CDs etc.

2.9 It should have facility for Data Storing in the kit & down loading to PC. It should have USB / Ethernet Interface.

2.10 It should have indications like HV Supply ON, Ground Open, Power Supply ON etc.

2.11 Protection against short circuit, over voltage, improper ground connection over load & transit surges, the kit should have alarm/cut-off features to protect the instrument. Also the kit should have facility of stopping automatically on power failure as well as interlock for HV.

2.12 Necessary inbuilt cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/accessory shall have to be required.

2.13 **Cables & Accessories:**

The equipment shall be complete with measuring bridge, HV power supply unit of 12kV, standard Capacitor, Laptop (of latest specifications, built-in display screen and all standard accessories including cables, hard carrying case(box) and fitted with trolley (if applicable) etc. Brief description of cables is as below:

- HV/LV screened Cable set – 20 Meters (Min.) with Clamps and connector
- Power Supply Cable
- Grounding Cable with Clamps
- One set of Interconnecting Cables

- Other cables and accessories required for carrying out measurement including temperature sensing probe.
- One set of Fuses and Indicating Lamps and other consumables shall be supplied with the kit.

2.14 It should have Data Analysis Software with the features of:

- Storing and downloading of files in data base for further analysis in PC
- Facility of drawing Graphs of tan δ (with and without temperature correction of tan δ values), frequencies etc. between voltages.
- Comparing of different value of same parameter at different period/time (trending).
- The data format shall be XML/CSV open with excel for easy transfer to data base applications.
- Facility to make reports in word/excel/pdf formats

3. Technical Parameters

Output voltage	0-12 kV (AC)(Continuously variable)
Output current	100 mA (Min) continuous & 200 mA (Min) intermittent
Output frequency	45Hz to 70Hz
Tan delta (DF)	Range: 0 to 200% Min. Accuracy : 1% of reading ± 0.0005 Resolution : 0.01% or better
Power Factor	Range: 0 to 100% Min. Accuracy : 1% of reading ± 0.0005 Resolution : 0.01% or better
Capacitance	Range: 10pF to 1μF Accuracy: 0.5% of reading ± 1 pF Resolution : ±1pF
Power Supply (input)	240 V ±10% AC, 50 Hz ±5%
Operating & Environment Conditions	Temp.- 0 to 50^{o}C Humidity- 90% not condensing The kit shall be compatible for EMI/EMC requirements as per relevant IEC.

4. Calibration certificate:-

As per requirement of ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.
Calibration certificate from NABL accredited lab or internationally reputed lab shall be submitted. Date of calibration shall not be older than three (03) month from the date of supply of kit.

5. The bidder will have to demonstrate the kit for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site upto the satisfaction of DTL at their own cost and **this will be the part of technical evaluation**. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

6. Warranty/Guarantee Period:

Min 03 years from the date of successful & complete commissioning at DTL sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of kit for repair at test lab / works.

7. Commissioning, Training and Handling Over of the Instrument

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demonstration at site shall be rejected and no repairs are allowed.
Bidder will have to provide training to DTL engineers for safe operation and maintenance of the instrument before handing over the same at DTL site in batches.

GUARANTEED TECHNICAL PARTICULARS FOR TAN DELTA KIT

(To be filled in and signed by the Bidder)

1	Name of manufacturer	
2	Type and Model	
3	Output voltage	
4	Output current	
5	Output frequency	
6	Tan delta (DF) i. Range ii. Accuracy iii. Resolution	
7	Power Factor i. Range ii. Accuracy iii. Resolution	
8	Capacitance i. Range ii. Accuracy iii. Resolution	
9	Power Supply (input)	
10	Operating & Environment Conditions	
i	Temp	
ii	Humidity	
11	Weight	
12	Cable & Accessories	

(ix) TRANSFORMER WINDING RESISTANCE METER

1.0 Functional requirement

1. The instrument should be suitable for offline measurement of winding resistance of transformer, including OLTC and reactors etc. up to 400KV in live switchyards up to 400KV level, as per applicable standards/testing procedure.

2. The instrument shall be able to provide the current vs time plot of OLTC from one tap to another.

3. It should have min .02 No. measuring channels.

4. The test results should have repeatability, consistency & immunity to interference in live switchyard up to 400KV levels.

2.0 Test Current

Minimum 25A DC continuous.

3.0 Resistance Measurement

Resolution: 0.1 μΩ up to 500 μΩ range and 0.02% of FS above 500 μΩ range. Accuracy value 0.5 % ± 2 digits.

4.0 Measurement Range

0-2000Ω Auto Ranging.

5.0 OLTC Testing

The kit should be capable of checking the current v/s time characteristics during the tap change. It should be able to display the magnitude of current variation during tap change operation in %. The kit should present the transition time from one tap to the next tap in the test results.

6.0 Open Circuit Voltage

50 V DC or more.

7.0 Temperature Correction

The kit should have the facility to have correction of resistance value to a reference temp. i.e. provide temp. compensated reading of resistance (for Copper & Aluminum).

8.0 Test Lead/Accessories

One complete set of cable of sufficient length (Min 20 Mtr) with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test in DTL substation. Additionally all the required accessories should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/rugged enough) for proper safety of the kit during transportation shall have to be provided. All the standard accessories for desired monitoring, operation & control of instrument shall have to be provided.

9.0 Design/ Engineering

The complete equipment along with complete accessories must be designed /engineered by Original Equipment Manufacturer.

10.0 Power Supply

It shall work on input supply variations, Voltage: 230±10%, Frequency: 50Hz ±5% on standard sockets.

11.0 Operating Temperature

Temp 0 to 50Deg.C

12.0 Relative Humidity

Maximum 90%, non condensing

13.0 Protection/Control

Against short circuit, over load, transient surges etc. The instrument should have facility of discharging the specimen when test is completed or when current cable is accidentally disconnected or when instrument power supply is lost. The kit should have built in rapid discharge circuit for automatically discharging the stored energy in the transformer at the end of each test.

14.0 Cooling arrangement

Necessary in built cooling, if required, arrangement should be provided to dissipate the heat generated during use. No external coolant/accessory shall have to be required.

15.0 Weight

It should be easily portable.

16.0 Software

The software should be suitable for automatic testing & report generation including temperature compensation. The kit should have facility to connect with windows based computer for exporting the test data.

17.0 Display/Control

Onboard laptop or external laptop of approved make/configuration, control (to be supplied with instrument).

18.0 Printer

Inbuilt printer.

19.0 Memory

Non-volatile memory to store minimum 1000 measurement.

20.0 Environment

The test kit shall be compatible for EMI/EMC/safety environment requirement as per IEC.

21.0 Calibration certificate

Unit shall be duly calibrated before supply and date of calibration shall not be older than 2 months from the date of supply of kit.

22.0 Training

Supplier shall have to ensure that the instrument is made user friendly. Apart from the detailed demonstration at site the supplier shall also have to arrange necessary training to DTL engineers.

23.0 Commissioning, Handing over of Instruments

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demonstration shall be rejected and no repairs are allowed.

24.0 Services after Sales

Bidder will have to submit the documentary evidences of having established mechanism in India for prompt services.

(x) Thermoscanning camera for transmission line and substation

Technical Specification of Thermo Vision Scanning Camera

Item	Specification
Functional Requirement	1. The instrument shall be thermal imaging system based on principle of infra-red radiation detection. It should be suitable for following measurement in live substations and transmission lines up to 400 kV level. I. The Absolute value of Hot spot temperature. II. Color thermal as well as visual image of focused object III. Isotherm 2. The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard

	upto 400 kV levels. 3. The measurement of ambient temperature.
Measurement Range	Temperature:0-500 º C
Detector Type / Infrared Pixels	320 x 240 pixels (Uncooled) Infrared Pixels to be captured by the camera and not enhanced after image capturing
Accuracy	T: ±2 º C or 2 % of Reading
IFOV or Spatial Resolution	Standard Lens: 1.4 mrad or better Telephoto Lens: 0.7mrad or better
Min. focus distance	50 cm
Focus	Auto / manual
Text annotation	Predefined by user and should be stored with image
Digital Video	1.3 MP (min.) color
Spectral Range	8µm to 13 µm (min)
Sensitivity	Min 0.1 ºC at 30 ºC or better
Emissivity Correction	Automatic temp. correction for emissivity (Variable from 0.1 to 1.0)
Accessories	One complete set of lens i.e. normal as well as telephoto lens, removable memory card (Min. 1 GB), PC communication cable, windows based software, battery set with adapter (02 set) etc, compatible with the instruments should be provided for successfully carrying out the test in DTL S/S and transmission line. Additionally all the required accessories, drawing & documents including Operating/Maintenance instruction manual, tools etc. should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.
Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
Power Supply	It shall work on single phase 230 Volts ±10 %, 50 Hz ±5 % supply with standard socket and Rechargeable Battery.
Rechargeable battery (1 battery capacity)	4 hours continuous operation
Operating Temperature	0 to +50 deg C
Degree of Protection	IP 54 (Min)
Relative humidity	Max. 90 % non-condensing
Protection/ Control	Against short circuit, over voltage, improper ground connection over load & transient surges, the instrument should have alarm/cut-off features to protect the instrument.
Mounting Arrangement	The necessary tripod mounting arrangement should be provided for long distance measurement.
Weight	The weight should be preferably less than 2.5Kg for easy portability.
Software	The software should be provided free of cost & suitable for report generation and temperature analysis on windows based platform. The instrument should have facility to store, in standard formats,

	and communicate with windows based computer for exporting the test data. USB port or any other arrangement shall be provided for downloading the images, etc via USB port.
Display/Control	3.5 ” LCD Display (Min)
Environment	The test kit shall be compatible for EMI/EMC/safety environment requirement as per IEC.
Guarantee	Warranty/Guarantee Period: Min 01 year from the date of successful demonstration of supplied equipment at DTL sub-station. All the materials, including accessories, cables etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works.
Calibration Certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two month from the date of supply of Kit.
Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to DTL engineers.
Commissioning, handing over the Instrument	Successful bidder will have to supply and demonstrate the instrument to the satisfaction of DTL. The instrument failed during the demonstration shall be rejected and no repairs are allowed.
After sales service	Bidder will have to submit the documentary evidence of having established mechanism in India for prompt after sale services.

Note: For substation purpose, only thermo scanning camera without telephoto lens is required whereas for lines purpose thermo scanning camera with telephoto lens is required.

(xi) Portable water PPM (moisture in oil) Testing kit alongwith weighing machine with each kit alongwith accessories

Technical Specification of “Automatic Water Content Measurement (PPM) instrument in Insulating Oil Using Coulometric Karl Fisher Titration Method”

1.0 **General :**

1.1 The testing instrument covered in this specification is generally meant for carrying out testing and maintenance at site/Laboratory and shall be complete with all material and accessories. These shall be robust in design, so that they give accurate results even in adverse site conditions.

1.2 Design, Manufacture, Testing at factory; Supply, Installation and commissioning of Water Content Measurement Kit of given specifications.

1.3 The intended use of Automatic Water Content Measurement Kit in insulating oil is to measure moisture content in insulating oil as per (IS-13567-2003, IEC-60814). As such the range and accuracy of the kit shall be sufficient to meet these testing requirements.

1.4 The equipment should be microprocessor controlled for determination of water in insulating oil by ‘Coulometric Karl Fischer Titration’ Method.

1.5 The equipment shall be robust, have automatic test sequences, automatic control with digital display and option to interface with computer to download test results.

1.6 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version.

1.7 The instrument should be complete in all respects & ready to use with all accessories as supplied with the instruments.

2.0 Functional Requirements:

2.1 The kit should have fully automatic EHV electrostatic and electromagnetic interference suppression. The kit shall be compatible for EMI/EMC environment as per IEC 61000.

2.2 Under very high/low ambient temperatures, high humidity, equipment shall be able to carry out measurement under these conditions.

2.3 Instrument should be designed on Coulometirc Karl Fischer Titration method for measuring moisture contents in PPM or micrograms or Percentage.

2.4 Instrument should have facility to automatic compensate Error generated due to change in electrolysis cell resistance so that calibration of reagent is not required.

2.5 All accessories and reagents should be supplied with equipments.

2.6 Latest windows based application software CD (Original) should be provided with the equipment for evaluation of test results.

2.7 Should be free from effect of humidity, parasitic reaction and inherent drift of circuitry.

2.8 Should have back up indication for mains on, instrument error, stirrer moving and titration over

2.9 Titrators offer a broad range of options for handling test results data. Choose whether to export as CSV, PDF or XML files. Devices such as printers or memory sticks can be connected via the USB port and are automatically recognized

2.10 **Solvent extraction unit:**

The kit should have the provision of extraction & addition of titration solvent to titration vessel by motorized automatic mechanism.

2.11 **SAFETY:**

Shock proof, Vibration proof, EMC compliant & Safety requirements as per relevant International Standards.

2.12 Technical Requirements:

Sr.No	Description	Details
i)	Method of Measurement	Microprocessor Controlled Determination of Water in Insulating Oil by Columetric Karl Fischer Titration Method.
ii)	Water Concentration	Above 2mg/Kg and Viscosity less than 100 mm^2/s at 40^0.C.
iii)	Iodine Production	Pulse of variation length and current density
iv)	Titration Speed	2.0 mg H_2O/min.
v)	Measuring Range	10µg to 10mg H_2O
vi)	Moisture Range	1 ppm to 100% of water

vii)	Resolution	0.1 µg H_2O
viii)	Precision/ Accuracy	Upto 3 µg for water of 100 µg or better; For more water 0.5% or better
ix)	Drift Compensation	Automatic
x)	Keypad/ User controls	Should be capable of carrying out all operational functions
xi)	Stirrer Control	The speed of the stirrer shall be microprocessor controlled. The speed of stirrer should preferably be controllable.
xii)	Modes	Standard/ Preset as well as User programmable
xiii)	Report Output	In Display as well as Printer, Result in ppm, %, µg, mg/kg formats
xiv)	Diagnostics	Should have error messages/ indications for any defects in vessel, solution, electrodes etc. as well as instrument error, mains on, stirrer moving etc.
xv)	Interface	Interface for balance and printer/ PC
xvi)	Power Supply	AC Voltage 230 V ±10 % Frequency 50 Hz ±5 %
xvii)	Printer	Built in printer or facility to connect external printer via USB/Serial Port/Ethernet/Bluetooth. Suitable Printer for printing the results
xviii)	05 ml Glass Syringe	02 Nos. 05 ml Hamilton Glass syringes
xix)	Display/ Key Board	Alpha numeric LCD/LED Display and key board

3.0 Auxiliary Spares: Apart from the standard supplied kit one set of Complete Titration Vessel assembly is also to be supplied by the supplier.

Should have 3 nos of syringes required for measurement and 6 nos of reagent bottle.

4.0 Supply of spares:

The Vendor shall ensure supply of spares/services for at least 7 years.

5.0 MANUAL: The supplier has to supply Instrument's Operation & Maintenance manual with circuit diagrams and troubleshooting guidelines...Operating / User's Manual in English.

6.0 Calibration certificate:-

Calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.

The instrument shall be supplies with proper Calibration certificate from NABL accredited lab or internationally reputed lab .Calibration certificate traceable to national/international standards from an international accredited laboratory with uncertainty calculations shall be provided. It is the responsibility of the supplier to provide the Calibration services to the instrument after the calibration interval is over. Date of Calibration Certificate shall not be older than three month from the date of supply of kit.

7.0 The bidder will have to demonstrate the kit for accuracy and repeatability shall be established at prescribed site of DTL/any other site/Lab including 400/220kV switchyard/site up to the satisfaction of DTL at bidder cost and this will be the part of technical evaluation. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

8.0 Warranty/Guarantee Period:

Min 03 years from the date of successful & complete commissioning at DTL sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of kit for repair at test lab / works.

9.0 After sales-service: The supplier should have adequate "After Sales Service" in India so that repair / calibration of the testing kit can be done in the short period of time.

10.0 Commissioning, Training and Handling Over of the Instrument

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demo shall be rejected and no repairs are allowed.

Supplier shall arrange exhaustive classroom training with the theory and practical session on the usage of the instrument by the technical expert of the Principal Company in our premises without any extra cost to DTL

Guarantee Technical particular "Automatic Water Content Measurement instrument in Insulating Oil Using Coulometric Karl Fisher Titration Method" (To be submitted by bidder)

S.No.	Parameters	(To be submitted by bidder)
1	Titration Method	
2	Electrolysis Control	
3	End Point Detection	
4	End Point Indication	
5	Measuring Range	
6	Moisture Range	
7	Resolution	
8	Drift Compensation	
9	Precision	
10	Method storage	
11	Display Format	
12	Print Format	
13	Start Delay	
14	Min. Titration time	
15	Stirrer Speed	
16	Stirring method	
17	Keypad/user Control	
18	Printer	
19	Carry case	
20	Power Supply	
21	Dimensions	
22	Weight	
23	Screen	
24	Instrument manuals	
25	Accessories/ Auxiliary Spares	

(xii) Technical Specification of 10kV Digital Insulation Tester:-

Functional Requirement	1. The instrument should be suitable for measuring insulation resistance and PI, in live switchyard up to 400 kV level, as per applicable standard testing procedure of DTL. 2. The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard up to 400 kV level. 3. The instrument should automatically discharge the energy transferred to test specimen at the end of test. 4. The instrument should have Guard Terminal to eliminate the effect of surface leakages etc. (with accuracy of ±2%)
Output	Voltage: 0-10kV in several steps (Digital) with range of 1 kV (or lower) to 10 kV (or higher).in 25V steps.
Short Circuit Current	Not less than 5mA
Accuracy	1. IR : ±05 % of reading 2. Voltage: ±05 % of reading
Measurement Range:	Insulation Resistance : 0-5T Ω(or higher) (Auto Ranging & Digital) Capacitance : up to 50µF
Test Modules	Auto IR, PI, DAR
Voltage measurement	0 to 600V AC or DC, ±3% accuracy
Leakage current measurement	0.01 nA to 5 mA
Test Leads and accessories	Two complete set of screened cables, each of 3m and 15m with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test in DTL S/S. Additionally all the required accessories should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust / rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.
Design/Engg.	The complete equipment along with complete accessories must be designed / engineered by Original Equipment Manufacturer.
Power Supply	It shall work on single phase 230 Volts ±10%, 50 Hz ±5% supply with standard socket along with Internal Chargeable Battery.
Operating Temperature	0 to ±50 deg C
Relative humidity	Max. 90% non-condensing
Protection/	Against short circuit, over voltage, improper ground connection
Control	Over load & transient surges, the kit should have alarm/ cut-off features to protect the instrument.
Weight	It should be easily portable
Display/control	Digital LCD/Keypad
Data storage	Data stored: selected voltage, test time elapsed, voltage applied, leakage current, and insulation resistance. The PI, DAR, capacitance, time constant and Dielectric Discharge (DD) values are also stored if available at the end of the test. Suitable Software may be used to transfer

	this data to a PC.
Environment & safety	The test kit shall be compatible for EMI/EMC/Safety environment requirement as per relevant IEC.
Applicable standards	As per relevant IS/IEC
Guarantee	Warranty/Guarantee period: Min 01 year from the date of successful & complete commissioning at DTL sub-station. All the materials, including accessories, cables etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's words for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of kit for repair at test lab / works.
Demonstration	The bidder will have to demonstrate the kit for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site upto the satisfaction of DTL at their own cost and this will be the part of technical evaluation. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.
Calibration Certificate	Calibration certificate from NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of kit.
Commissioning, handing over the Instrument	Successful bidder will have to commission the instrument to the satisfaction of DTL. The supplied instrument, failed during the demonstration at site shall be rejected and no repairs are allowed.

Guaranteed Technical Particulars for 10kV Digital Insulation Tester:-

Sr. No.	Description	To be submitted by Bidder
1.	Name of manufacturer	
2.	*Type & Model*	
3.	Input Supply (A.C.)	
4	*Output*	
5	*Short Circuit Current*	
6	*Accuracy*	
7	*Measurement Range:*	
8	*Test Modules*	
9	*Voltage measurement*	
10	*Leakage current measurement*	
11	*Test Leads and accessories*	
12	*Operating Temperature/ Relative humidity*	
14	*Protection/ Control*	
16	*Display/ Weight*	
17	*Data storage*	
18	*Environment & safety*	
19	*Applicable standards*	
20	*Guarantee*	
21	*Calibration Certificate*	

(xiii) Technical Specifications for Automatic Transformer Oil Breakdown Voltage (BDV) Tests along with Standard Accessories:-

1) General Requirements

1.5 The testing equipment shall be type tested and shall be subjected to acceptance and routine tests in accordance with the requirements of relevant national/international standards with latest version

1.6 Kit should be able to measure Transformer Oil Breakdown Voltage (BDV) Tests along with Standard Accessories automatic without balancing any decade and also interference suppression shall be automatic.

1.7 The instrument should have been proven for repeatability of test result in charged switchyard of EHV substations.

1.8 The kit and accessories shall be robust and rugged enough, so that it can be transported safely to different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit. Further, the instrument shall be robust enough to sustain the jerks during the transportation in local condition.

1.9 Bidder will have to submit the documentary evidences of having established mechanism for prompt services in India as and when required by DTL. Bidder need to submit their organization service chart along with bid.

1.10 The kit should be capable of operating and storing data at temperature from 0 degree C to 50 degree C and humidity up to 95%.

10. Functional Requirement

10.1 The equipment offered shall be suitable for determination of electrical strength (Break Down Voltage) of insulating oil conforming to IS-335 and IS-1866 upto 100KV, when measured in accordance with IS:6792.

10.2 The test cell shall be as per IS: 6792 and IEC 156-1995 suitable for BDV upto 100kV without external flash over.

10.3 The unit shall be automatic type having control unit and high voltage transformer in a common cabinet with necessary partition.

10.4 HV chamber interlocking and zero start interlocking shall be provided.

10.5 The unit shall have motorized drive to increase voltage linearly as per the rate specified in IS: 6792. Provision shall also be available for manual increase of voltage

10.6 The unit shall be complete with test cell stirrer, calibrator and necessary gauges for adjusting the gap.

10.7 The equipment shall be suitable for operation at 240 volts +/- 10% 50Hz +/- 5% single phase AC supply.

10.8 The instruments should be capable of storing the test results. The results should be easily down loadable to a PC through RS232 and USB interface

10.9 The instrument should have a built–in printer for getting a hard copy of test results with and without the need for downloading to a PC but provision of RS-232/USB interface must be present.

10.10 The test set should be either magnetic stirring or propeller stirring facility.

3.0) Technical Parameters:-

S.No.	Parameters	Technical Specifications
1	Applicable Indian / International standards for the equipment	ASTM D 877B-02, IS 6792
2	Environment	The test kit shall be compatible for EMI/EMC/Safety environment as per LATEST IS/IEC
3	Power Supply voltage in volts.	240V ± 10%, 50Hz ± 5% on a standard socket
4	Measurement standard	IEC 60156–95, IEC-156-1995 & ASTM method
5	Protection provided to equipments.	1. HV Chamber interlocking. 2. Zero starts interlocking.
6	Display.	LCD/LED with alphanumeric keypad to facilitate entry of test ID notes etc
7	Test output voltage.	Suitable for BDV up to 100KV without external flashover. 0.1kV ±1% ±2 digits. (Rate of rise :2 kV/sec)
8	Standard Accessories	1. Test cell 400ml with lockable gap setting, test cell stirrer, calibrator. 2. Flat electrode gap gauge – 1mm & 2.5mm. 3. Electrodes should be supplied as per IEC60156 4. Printer should be in-built. 5. Hard carrying case
9	Additional features of equipments.	1. The Unit shall be fully automatic type having control unit & high voltage transformer in common cabinet with necessary partition. 2. Automatic oil temp. measurements with a resolution of 1°C 3. Large, easy clean test chamber with oil drain. High visibility of test chamber.
10	Operating temp. range of equipment in degree C.	0 to 50^0C
11	A)Breakdown detection should perform in terms of both "Voltage" and "Current" Trip time should be less then 10mSec B) The short-circuit current of the transformer and associated trip time Required as per IEC156 shall be 4mA for 5ms and 1ms in case of Silicon oils. Normal breakdown detection speed shall be within 10msec. C) The HV switch off time shall be <10µs automatically if an established arc of 4mA occurs for 5ms as per IEC156.	
13	Non condensing operating humidity range for equipment in %.	5 to 95%
14	The equipments shall be work in presence of high interference / high voltage.	
15	Service life of the	Should be specified by supplier.

	equipments in years.	
16	*Whether the kit has USB port facility.*	*Yes, for printing data and requirement of software for downloading data & inter prediction of test result. Software should be window base.*

4) ***Calibration certificate:-***

As per requirement of ISO-9001, calibration certificate for each testing instrument covering entire range shall be supplied with the test kit at the time of supply.

Calibration certificate from NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than one month from the date of supply of kit.

5) Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to DTL engineers.

The bidder will have to demonstrate the kit for accuracy and repeatability under stringent field conditions at prescribed site of DTL including 400kV switchyard/site upto the satisfaction of DTL at their own cost and this will be the part of technical evaluation. Successful demonstration of equipment shall be the pass / fail criteria for further evaluation / rejection of bid. The instrument failed during demonstration shall be rejected.

6) ***Warranty/Guarantee Period:***

Min 05 years from the date of successful & complete commissioning at DTL sub-station.All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of kit for repair at test lab / works.

7) Commissioning, Training and Handling Over of the Instrument

Successful bidder will have to commission the instrument to the satisfaction of DTL. The instrument failed during the demo shall be rejected and no repairs are allowed.

Bidder will have to provide training to DTL engineers for safe operation and maintenance of the instrument before handing over the same at DTL site in batches."

Guarantee Technical particular Automatic Transformer Oil Breakdown Voltage (BDV) Test Kit along with Standard Accessories:-

S.No.	***Parameters***	***Technical Specifications***
1	*Applicable Indian / International standards for the equipment*	
2	*Environment*	
3	*Power Supply voltage in volts.*	
4	*Measurement standard*	
5	*Protection provided to equipments.*	
6	*Display.*	
7	*Test output voltage.*	
8	*Standard Accessories*	
9	*Additional features of equipments.*	
10	*Operating temp. range of equipment in degree C.*	
11	*Non condensing operating humidity range for equipment in %.*	
12	*Service life of the equipments in years.*	
13	*Whether the kit has USB port facility.*	

(xiv) Technical Specification of Automatic Transformer Turn Ratio Meter

1.0 Functional requirement

1.1 The equipment offered shall be used for automatic measurement of turns ratio (3phase simultaneously), exciting current, ratio error, and phase angle deviation, tap position for power transformers, instrument transformers and distribution transformers and CT and PT's by directly connecting the instrument to equipment. The instrument should have the provision for measurement for single phase also.

1.2 It should measure actual turn ratio of different, vector groups, phase, tap-position, ratio and deviation, phase angle and deviation, in three phase transformers without conversion and should also give magnetizing current indication.

1.3 Kit should have facility for operator to enter the ratio of the transformer and all of it's taps to the operator to know immediately when a tap is outside the acceptable limits. It should also have facility to enter pass/fail limit so problem taps can be easily flagged.

1.4 It should easily portable.

1.5 Automatic range selection and self-calibration for each test.

2.0 Display

Digital LCD display with backlight viewable in bright sunlight.

3.0 Ratio measuring range and accuracy

1-*10000:1 minimum with accuracy of 0.1% to 0.5% maximum at different ranges*

4.0 Test Voltage

8 to 80V rms minimum, automatically or manually selected

5.0 Magnetising Current

1mA to 2000mA @ 0.1mA and Accuracy = ± 5mA

6.0 Phase angle Range

±90º @ resolution 0.1 º and accuracy ± 0.5 º

7.0 Data Entry

Through instrument mounted key board/front panel/external key board.

8.0 Power Supply

It shall work on single-phase 230±10% V, 50±5% Hz, supply with variations in voltage and frequency respectively.

9.0 Protection of Kit

Kit should have all necessary protections against transient surges, over voltages, induction, short circuits etc.

10.0 Storage

Internal, nonvolatile memory for storing up to minimum 100 sets of three-phase measured and calculated ratio, exciting current, phase, ratio error, and name plate details of transformer.

11.0 Repeatability

It should offer repeatability of test results in 220 kV/400 kV charged area.

12.0 Software

The kit should have facility to connect with windows based computer for exporting the test data. The software should be suitable for data storage, report printout, and download of data etc. The original software in CD shall be handed over to DTL during the commissioning.

13.0 Interfacing PC

The kit shall be provided with necessary ports (RS232/USB/ equivalent) to interface the other peripherical devises such as printers, portable drive, etc.

14.0 Accessories

Complete set of test leads (min. 20 meter) with clamps and connectors, PC cables, Licensed OS software, Licensed software of the testing kit, combination plugs, power-supply cables, original hard carrying case for main kit and cables (which should be robust/ rugged enough for proper safety of the kit during transportation), manual (both in soft copy & hard copies) etc, required for carrying out all types of testing.

15.0 Cooling arrangement

Necessary in built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/accessory shall have to be required.

16.0 Printer

Thermal/Normal printer, inbuilt or external.

17.0 Calibration certificate

Kit should have automatic self calibration feature. However party will have to submit the calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab, shall be submitted. Date of calibration shall not be older than two months from the date of supply of Kit.

18.0 Environment

a. The test kit shall be compatible for EMI/EMC/safety environment requirement as per IEC 61000.

b. Temp 0 to 50Deg.C,
c. Humidity not condensing-upto90%,

19.0 Warranty

Kit shall have Warranty for minimum 5 years for smooth and reliable operation of the kit. The warranty includes:

i. Calibration of instrument (annually till completion of 5 years)
ii. As much as visits for repairs to site.
iii. If the kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of spares, softwares, transportation, transit insurance (To & Fro), etc of kit for repair at test lab/works. Kit after repairs need to be returned within thirty days from the date of despatch.
iv. All the expenses for maintaining the supplied instrument "Healthy and in working condition" is to be borne by Successful bidder as per LOA.

20.0 Transit Case

The kit and accessories shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit.

21.0 Services after Sales

Bidder will have to submit the documentary evidences of having established mechanism for prompt services as and when required by DTL. Bidder need to submit their organisation service chart along with bid.

22.0 Demonstration and Handing over of Instruments

The contractor shall have to demonstrate the instrument to the satisfaction of DTL. The Supplier shall have to ensure the kit is made user friendly apart from the detailed demonstrations at each site. The instrument failed during the demonstration shall be rejected and no repairs are allowed.

ANNEXURE-A: COMPLIANCE CERTIFICATE OF TECHNICAL SPECIFICATION

The bidder shall confirm compliance to the following by signing and stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the schedule of deviations.

3. Only those technical submittals which are specifically asked for in Notice Inviting Tender (NIT) to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of technical offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

ANNEXURE-B: DEVIATION/ CHANGE REQUEST OF TECHNICAL SPECIFICATION

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason/ Justification(s)

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature

ANNEXURE-C : CHECKLIST FOR TECHNICAL EVALUATION

Along with the technical offer/ bids, the bidder should submit this checklist confirming the inclusion of the enclosures as listed below,

Sl. No.	Documents to be enclosed	Bidder to confirm (Please tick "Confirmed")
1.	Supporting documents for compliance of Technical Qualifying Requirement.	Confirmed
2.	Unpriced BOQ duly mentioning "Quoted" for all the items, signed and sealed.	Confirmed
3.	Annexure-A & B duly filled, signed and sealed.	Confirmed

Note: Any bidder not meeting the above requirement is liable for non-evaluation.

The above checklist is reviewed and verified for,

NIT Reference No.:

Name of Bidder:

Name of Project:

Date: Bidder's Stamp & Signature

Annexure-Technical Qualifying Requirement

220kV Gas Insulated Switchgear with its accessories Design, Engineering, Supply, Erection, Testing & Commissioning of 220 kV GIS at 220 kV Subzi Mandi Substation on turnkey basis Technical Specification: TB-PBTU-DTL-SBJM-GIS
The bidder shall be Indian GIS manufacturer, who meet the requirement of Route-1(Clause 1.1.A)/ Route-2(Clause 1.2)/ Route-3(Clause 1.3), while fulfilling all additional requirements as per respective clauses,
Route-1: 1.1. A) The Bidder/ Manufacturer must have designed, manufactured, tested$ (as per IEC or equivalent standard), supplied, supervised erection and commissioning of at least two (2) nos. GIS circuit breaker bays* of 220 kV or above voltage class in one (1) GIS substation or Switchyard during last seven (7**) years and these bays must be in satisfactory operation# for the last two (2) years ending last day of month previous to the one in which tender is invited. OR The Bidder/ Manufacturer must have designed, manufactured, tested$ (as per IEC or equivalent standard), supplied, erected and commissioned at least two (2) nos. GIS circuit breaker bays* of 220 kV or above voltage class in one (1) GIS substation or Switchyard during last seven (7**) years and these bays must be in satisfactory operation# for the last two (2) years ending last day of month previous to the one in which tender is invited. Performance certificate for satisfactory operation issued by the Power utility certifying the operation without any adverse remarks should be of last two (2) years ending last day of month previous to the one in which tenders are invited.
OR Route-2: 1.2.) In case, the Bidder is not meeting the requirement stipulated in Route-1 (clause 1.1A), he shall also be considered, provided he meets the following requirements, a) The bidder must have established manufacturing and testing facilities in India for 220 kV or above voltage class GIS and must have manufactured at least one (1) no. 220 kV or above voltage Class GIS Circuit Breaker bay* based on the technological support of the Collaborator(s). Further the bidder must have either supplied or type tested the above GIS bay* as per IEC as on ending last day of month previous to the one in which tender is invited, provided further that the collaborator(s) of the bidder meets qualifying requirements as per para/ clause 1.1A mentioned above.

Annexure-Technical Qualifying Requirement

Further, the bidder shall also submit the following along with the bid,

i) A legally enforceable undertaking (jointly with the Collaborator(s)) to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s);
ii) A confirmation letter from the Collaborator(s) stating that the Collaborator(s) shall also furnish performance guarantee for an amount of 10% of the ex-works cost of such equipment(s). This performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder.
iii) A valid collaboration agreement for technology transfer/ license to design, manufacture, test and supply 220 kV or above voltage class GIS equipment in India.

OR

Route-3:

1.3.) In case, the Bidder is established as Subsidiary/ JVC/ Group company by its parent/ principal/ subsidiary/ sister concern##, he shall also be considered, provided he meets the following requirements,

a) The bidder/ manufacturer must have established manufacturing and testing facilities in India for 220 kV or above voltage class GIS and must have manufactured at least one (1) no. 220 kV or above voltage Class GIS Circuit Breaker bay• based on the technological support of the parent/ principal/ subsidiary/ sister concern## company.

Further, the bidder must have either supplied or type tested the above GIS bay• as per IEC as on the ending last day of month previous to the one in which tender is invited. Provided further that the parent/ principal/ subsidiary/ sister concern## company of the bidder meets qualifying requirements as per para/ clause 1.1A mentioned above.

Further, the bidder shall also submit the following along with the bid,

i) A legally enforceable undertaking (jointly with the parent/ principal/ subsidiary/ sister concern##company) to guarantee quality, timely supply, performance and warranty obligations as specified for the equipment(s);
ii) A confirmation letter from the GIS manufacturer/ GIS Collaborator/ Parent/ Principal/ Subsidiary/ JVC/ Group/ sister concern##company etc. as applicable that they shall also furnish performance guarantee for an amount of 10% of the ex-works cost of such equipment(s). This performance guarantee shall be in addition to Contract Performance Guarantee to be submitted by the bidder.
iii) A valid collaboration agreement for technology transfer / license to design, manufacture, test and supply 220 kV or above voltage class GIS equipment in India.

Annexure-Technical Qualifying Requirement

Note (s):

1. The offered GIS design should have been type tested as per relevant IEC with valid type test reports in line with CEA guidelines.

2. (#) Satisfactory operation means certificate issued by the Employer certifying the operation without any adverse remark.

3. (*) For the purpose of qualifying requirement, one no. of circuit breaker bay shall be considered as a bay used for controlling a line or a transformer or a reactor or a bus section or a bus coupler and comprising of at least one circuit breaker, one dis-connector and three nos. of single phase CTs / Bushing CTs.

4. In case bidder is a holding company, the technical experience referred to in Route-1, 2 and 3 above as the case may be, shall be of that holding company only (i.e. excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred to in Route-1, 2 and 3 above as the case may be, shall be of that subsidiary company only (i.e. excluding its holding company).

5. (**) For the purpose of qualifying requirement, during the last seven years means that commissioning date is to be within a period of seven years ending last day of month previous to the one in which tender is invited.

6. In case bidder is qualifying through Route-1, type test reports of Collaborator/ Parent Company/ Subsidiary Company/ Group Company/sister concern## shall also be acceptable, for which a confirmation shall be furnished along with the bid as per format attached in the bidding documents.

7. ## Sister Concern of bidder means the company which has same parent as that of the bidder.

8. $ Tested means the design of the 220 kV GIS has been type tested as per IEC with validity as per CEA guidelines. Performance certificates submitted by the bidder shall be of the same design of GIS whether type tested or not. The offered GIS by the bidder shall also be of the same design.