Enquiry

Bharat Heavy Electricals Limited
Transmission Business Group
Materials Management

Project : PGCIL N.E.AGRA HVDC

Enquiry No	Enquiry Dt	Rev No	Rev Dt	PI No	Enquiry Type	Inspection by	Due Dt	Commercial Comments	Technical Comments	Signing Authority
332E255	06-Oct-12	0		342220204	Package	Customer	07-Nov-12	As per BHEL standard terms & Conditions.	As per technical specification No. TB-343-558-033 Rev01 and general terms techincal requirement section 3 No. TB-343-316-000,Rev02.	Engineer/TBMM

Document Enclosed

- Technical Specifications
- Terms & Conditions for Indigenous Enquiry
- Activity Schedule
- Schedule of Information (checklist) to be furnished
- Schedule of Technical Deviation

SN	Equipment	Phy Unit	Qty	Plan Dt	Comments
1	ILLUMINATION EQUIPMENT ILLUMINATION SYSTEM AS PER TECHNICAL SPECIFICATION TB-343-558-033 REV. 01	LOT	1		LOA REF: BB. II. A.23.1, BB. II. A.23.2, BB. II. A.23.3,BB. II. E.14.1, CC.II.A. 23.1

You are requested to submit your most competitive offer so as to reach us positively by the tender opening date & time. THE TENDERS NOT RECEIVED WITHIN SCHEDULED DATE AND TIME ARE LIKELY TO BE IGNORED. BHEL shall not be responsible for any postal delay.

IN YOUR OWN INTEREST YOU ARE ADVISED TO CAREFULLY READ "THE INSTRUCTIONS TO BIDDERS". INCOMPLETE BIDS AND/OR BIDS NOT COMPLYING WITH TENDER CONDITIONS SHALL BE TREATED AS NON RESPONSIVE AND ARE LIKELY TO BE IGNORED.

In case Tender Documents are not received within 7 days of this E-mail message, intimate BHEL accordingly. If no intimation is received, it will be considered that you have received tender enquiry and delay in submission offer due to late receipt of tender documents will not be entertained.

YOU ARE REQUESTED TO SUBMIT YOUR MOST COMPETITIVE OFFER SO AS TO REACH US POSITIVELY BY 2 PM ON THE TENDER OPENING DATE AND TENDER WILL BE OPENED AT 2:30 PM WITH EFFECT FROM 15-SEP-09.

BHEL RESERVES THE RIGHT TO OPT FOR REVERSE AUCTION FOR OBTAINING BEST PRICES.

OFFERS THROUGH E-MAIL / FAX:

WHOSOEVER DESIRES TO SEND OFFERS ON THEIR OWN RISK (COMPLETE IN ALL RESPECTS) VIA E-MAIL or FAX HAVE TO SEND THE OFFERS TO THE COMMON E-MAIL ADDRESS tenderbox@bhelindustry.com or 011-24365869 FAX .

THE RECEIVED EMAIL OFFERS WILL BE PRINTED BY PURCHASE COORDINATOR AND PUT THEM INTO COVERS AS PER CONVENTIONAL METHOD FOR TENDER OPENING I.E., TECHNO COMMERCIAL & PRICE OFFER SHALL BE PUT INTO TWO SEPARATE COVERS AND BOTH THE COVERS ARE KEPT IN THIRD COVER DULY SUPER SCRIBING ENQY. NO. AND DUE DATE.

OFFERS SENT TO ANY OTHER E-MAIL ID or FAX NO AND INCOMPLETE OFFERS SHALL NOT BE CONSIDERED FOR EVALUATION PURPOSE.

It is suggested that the bidders are advised to send the files with 'password protection'. procedure for giving a password to a file has been given below:

For saving Excel file with password

Steps to be followed:

1. Click on the FILE option in XP system and Start sign in Vista system then go to SAVE AS option.
2. Select the location to save and Click on the TOOLS box and go to GENERAL OPTION.
3. It will ask for the password, type the password into open or modify box or both as required.
4. Then click on the OK button it will ask for reenter of the password.
5. After reentering the password click on the save box.

For saving Word file with password

Steps to be followed:

1. Click on the FILE option in XP and Start sign in Vista then go to SAVE AS option.
2. Select the location to save and Click on the TOOLS box and go to SECURITY OPTION in XP system and GENERAL OPTION in Vista system.
3. It will ask for the password, type the password into open or modify box or both as required.
4. Then click on the OK button it will ask for reenter of the password.
5. After reentering the password click on the save box.

The venders who has sent offers with password,the passwords are to be forwarded to another email id:supplierinfo@bhelindustry.com

MSME STATUS

"THOSE INDUSTRIES WHO HAVE FILED A MEMORANDUM WITH THE CONCERNED AUTHORITIES AND REGISTERED AS MICRO & SMALL ENTERPRISE UNDER MICRO, SMALL AND MEDIUM ENTERPRISES DEVELOPMENT ACT 2006, HAVE TO SUBMIT A COPY OF SUCH REGISTRATION CERTIFICATE / MEMORANDUM TO BHEL FOR NECESSARY COMPLIANCES OF THE ABOVE ACT".

Please acknowledge the receipt of tender enquiry and fax back this letter by ticking the appropriate item below.

for BHARAT HEAVY ELECTRICALS LTD

We acknowledge the receipt of tender.

(a) The offer against subject enquiry shall be submitted by the scheduled date and time.

(b) We regret to quote. The item in reference is out of our manufacturing range.

(c) We regret because of our prior commitments.

(d) Any other reason.

To
Rajiv Ranjan
Dy Manager
TBG, Industry Sector,
Integrated Office Complex,
Lodhi Road,
New Delhi-110003

Ph: 011-41793293 / 24302293
Fax: 011-24365869

Signature and Seal of Tenderer

Enquiry No : 332E255 **Enquiry Dt :** 06-Oct-12

ENQUIRY NO. 332E255

Dated : 06.10.12

BHEL/TBG/SO1/01

CHECKLIST

SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

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

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

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

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal ……..

Date ……..

Annexure to GTC (BHEL/TBG/GTC/02-07) (for Indian Vendors only)

Enquiry No:332E255Dated 06.10.12

Mentioned clauses of General Terms and Conditions are to be read as follows:

Clause 1:

8. **Not Applicable.**

Clause 2: PRICES
A.1.: Applicable.
A.2.: Not Applicable.

B.1.: Applicable.

B.2. Not applicable

B.3. Not applicable

Clause 3: TERMS OF PAYMENT
Terms for BOI is Not applicable.

Terms for BOP is applicable.

Clause 16: ARBITRATION

The arbitration shall be under **'The Arbitration and Conciliation act 1996'.**

For said/subject procurement, BHEL reserves the right to resort for reverse auction to obtain best prices.

All remaining terms which are not mentioned here shall remain unchanged.

Note-

1. Proposed delivery plan is as follows: Agra A-01-feb-2013: Agra B- 01-10-13.

However vendor has to quote their best delivery plan in activity schedule.

1. Supplier has to specifically indicate/ tick mark their preference for Performance Bank Guarantee out of the three options mentioned in clause no.6 of the General terms and conditions (BHEL/TBG/GTC/02-07).

Annexure to GTC (BHEL/TBG/GTC/02-07) (for Foreign Vendors only)

Enquiry No: 332E255 Dated 06.10.12

Mentioned clauses of General Terms and Conditions are to be read as follows:

Clause 1:

8. **Not Applicable.**

Clause 2: PRICES
A.1.: Applicable
A.2.: Not applicable
B.1.: Applicable.
B.2. Not applicable.
B.3. Not applicable
Clause 3: TERMS OF PAYMENT
LR to be read as Bill of Lading/AWB.

Terms for BOI is Not applicable.

Terms for BOP is applicable.

Clause 16: ARBITRATION

The arbitration shall be under **'The Arbitration and Conciliation act 1996'.**

For said/subject procurement, BHEL reserves the right to resort for reverse auction to obtain best prices.

All remaining terms which are not mentioned here shall remain unchanged.

Note-

1. Proposed delivery plan is as follows: Agra A-01-feb-2013: Agra B- 01-10-13.

However vendor has to quote their best delivery plan in activity schedule.

1. Supplier has to specifically indicate/ tick mark their preference for Performance Bank Guarantee out of the three options mentioned in clause no.6 of the General terms and conditions (BHEL/TBG/GTC/02-07).

2. Price Break up should consist of the following breakup :-
   a- FOB port of Loading.
   b- Marine Freight from load port to discharge port i.e. any Indian port.
   c- Marine Insurance from load port to discharge port i.e. any Indian port.

Marine Freight and Insurance to be quoted separately.

BHEL may arrange Marine Shipment or exercise option for shipment by vendor at quoted F&I rates. Freight & Insurance from discharge port to site – BHEL's scope. Rates will be based on BHEL's applicable rate contract for arriving at landed cost to BHEL. However vendor may also quote for the same.

Freight and Insurance to be quoted separately.

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

Sr. No	Terms & Conditions
1.	1. Sealed quotations are invited for the items mentioned in the enquiry. Quotations should be typed and free from over writing and erasures, corrections or additions must be clearly written both in words and figures and attested, otherwise offer may be rejected. 2. Bidder must ensure that their quotation is received / dropped in the tender box on or before 02.00 PM of the due date of opening in **Material Management Division,** **Transmission Business Group,** **BHEL, Industry Sector,** **Integrated Office Complex,** **Lodhi Road, New Delhi – 110 003.** 3. The same shall be opened at 02.00 PM on the same day. Tenders received late may be rejected. Bidders sending tenders by courier or post, to ensure that it is delivered one day before as same day delivery may not reach above office by due time. 4. Bids are to be submitted in Two parts: i) Techno-commercial bid (Part I) – To be submitted in duplicate. A copy of price bid (Part II) (without prices) is also to be enclosed in Part I bid. ii) Price bid (Part II) – To be submitted only in one copy in a separate sealed envelope. This should not contain any Technical or Commercial Terms. The rates should be quoted both in figures and words. In case of any difference between figures and words, the quoted rate in words will prevail over figure. Both Part I and Part II bids are to be sealed in separate envelope and both envelops to be kept in another common envelope. Each envelope should be sealed and super scribed with enquiry no., item / package name, project name and due date of opening. 5. For any Technical clarification, please contact Mr. Neeraj Kumar (Dy Manager) BHEL, Integrated Office Complex, Lodhi Road, New Delhi – 110 003 Phone : 011-41793550 Fax : 011-417934474 e-mail :neeraj@bhelindustry.com For any commercial clarification please contact person issuing enquiry. 6. Price bid should not contain any information / description / terms & condition other than given in Part-I of the bid except prices, otherwise bid is liable for rejection. **7. Price bid submitted along with the bid shall remain valid up to validity of offer. Unsolicited Supplementary / Revised price bid submitted during validity period of offer, unless asked by BHEL, shall not be considered. With-drawl of quotation by the bidder, at any stage after its opening, may entail blacklisting of vendor.**

Sr. No	Terms & Conditions
	8. Enquiry condition for where the scope against this tender includes Installation and Commissioning of the equipment / material There will be separate contract awarded for Supply portion and Site execution portion. For Supply portion General Terms and Conditions mentioned here shall be applicable for Site execution portion, Terms and conditions for Installation services shall be applicable. However, any breach in either of the contract shall be deemed as the breach of other contract also.
2.	**PRICES:** **<RELEVANT OPTION TO BE SELECTED BEFORE ISSUE OF ENQUIRY>** **A.1.** Unless specifically indicated, all prices shall be **FIRM.** No enhancement of rate for whatever cause unless and until asked by BHEL will be allowed. **A.2. PVC (if indicated)** The prices to be quoted are with **PVC** with following formula. <*Formula*> The base indices in the formula shall be of first notification of ---------- of the --------- month. The date of delivery shall be PO delivery date or date of actual despatch, whichever is earlier. **B** The prices shall be quoted by the vendors considering following. **B.1.** Unless specifically indicated, the prices shall be on **Domestic basis.** **B.2. Deemed export (if indicated)** i) Prices are to be quoted considering following benefits: 1. ---------- 2. ---------- 3. ---------- ii) For availing above benefits, BHEL shall provide following documents. 1. ---------- 2. ---------- iii) In case of import benefit in deemed export projects, bidder to indicate import content (CIF value) in the price bid.
	B.3. Physical export (if indicated) i) Prices are to be quoted considering following benefits 1. ---------- 2. ---------- ii) For availing above benefits BHEL shall provide following documents 1. 2._____ __ **C**. The prices are to be quoted on FOR (Destination) basis. The break-up of price shall be as under:- **a) Ex-works Price:** Ex- works price including packing & forwarding charges. **b) Excise duty:** ED as applicable is to be quoted as percentage in both un-price and price bid.

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	c) Sales Tax: ST / VAT /CST (against C-form) to be quoted as percentage in un-price and price bid. In case of interstate sale-in-transit supplier have to provide E1/E2 form. **e) Entry tax / Octroi Charges:** Any Entry tax / Octroi applicable at destination / destination state shall be paid extra on proof of such payment. **f) Freight & Insurance:** Freight and Transit Insurance for door delivery up to destination/store is to be quoted. **g) Type Test charges:** If asked in the technical specification, is to be quoted separately for each Test along with taxes and duties applicable on them. **h) Erection / Commissioning supervision charges:** If asked in the technical specification, to be quoted separately along with taxes and duties applicable on them. Note : The purchase order shall be placed on Ex-works basis.
3.	**TERMS OF PAYMENT :** **<RELEVANT OPTION TO BE SELECTED BEFORE ISSUE OF ENQUIRY>** <u>For BOIs (non package items)</u> 100% payment along with taxes, duties, Freight & Insurance within 60 days from the date of receipt of complete invoice containing following documents in 3 sets (Original + 2 copies). - Receipted LR - Excise invoice (where ED re-imbursement is required) - Delivery Challan / Packing list (casewise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers, - Despatch Clearance given by BHEL, - Guarantee certificate, - All Test reports and inspection reports, - Performance Bank Guarantee copy. <u>For BOPs : Air-Conditioning & Ventilation, Fire Protection, Illumination, Oil handling system where ETC is in scope of bidder</u> a. 90% of Ex-works value alongwith 100% taxes, duties, Freight & Insurance within 60 days from the date of receipt of invoice. The invoice must contain following documents in 3 sets (Original + 2 copies) - Receipted LR / RR - Excise invoice (where ED re-imbursement is required) - Delivery Challan / Packing list (casewise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers, - Despatch Clearance given by BHEL, - Guarantee certificate, - All Test reports and inspection reports, - Performance Bank Guarantee copy.

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	b. 5% of Ex-works value on completion of supplies as per billing breakup. c. 5% of Ex-works value on successful completion of Erection, Testing, Commissioning (To be certified by BHEL site) and final documentation (Against proof of submission to Engineering) Note: When ETC is not in scope last 5% as per (c) above shall be paid alongwith (b). Terms of payment for Type test charges: 100% payment with taxes and duties on acceptance of test reports by BHEL on certification by BHEL engineering within 60 days from the date of receipt of clear invoice. Terms of payment for Supervision charges: 100% payment against completion with taxes and duties on certification by BHEL site within 60 days from the date of receipt of clear invoice.
4.	**INTEREST LIABILITY** In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment.
5.	**GUARANTEE :** The equipment / material shall be guaranteed for 18 months from the date of delivery or 12 months from the date of commissioning, which ever is earlier. The defective material / component shall be replaced free of cost at site. **<FOLLOWING TO BE DELETED IN ALL ENQUIRY OTHER THAN ILLUMINATION PACKAGE>** However for Illumination system after commissioning Lamps, Tubes, Ballast, Starters, Capacitors, Fuses will not be covered in Guarantee.
6.	**PERFORMANCE BANK GUARANTEE :** **<PBG CLAUSE TO BE REMOVED BEFORE ISSUE OF ENQUIRY FOR ITEMS FOR WHICH PBG IS NOT REQUIRED>** Bidder shall furnish along with first invoice Performance BG / deposit as per one of following 3 options. Option A A single rolling Bank Guarantee of Rs 20 lakhs initially valid for one year for all the orders being executed for Transmission Business Group, BHEL. Option B BG for 10% of the total Ex-works PO value, valid for 24 months from the date of first delivery. PO value at the time of first invoice for the particular order shall be considered for calculation of BG amount. Option C Retention of 10% of the total Ex-works PO value by BHEL from the first bill in lieu of Performance Bank Guarantee, to be released after expiry of 24 months from the date of first delivery. Note : For Shield wire, Earthing material, Cable gland, Cable Trench material, GI/PVC pipe, Hardwares, Al tube, MS Rod, Lable & phase colour disc, HG Fuse, Ferrule, Lug, Marker, Stationary, Office eqpt. and any petty / sundry purchase no

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	Performance bank guarantee is required. The Bank guarantee shall be from State Bank of India / State bank of Hyderabad / State Bank of Travancore / State Bank of Mysore / Canara Bank / Bank of Baroda / Punjab National Bank / Deutsche Bank / HDFC Bank / Standard Chartered Bank / CITI Bank / ICICI Bank / IDBI Bank / HSBC / any other Nationalised Bank. The original BG should be sent by issuing Bank directly to AGM(Finance), TBG, BHEL.
7.	**FINAL ENGINEERING DOCUMENTATION:** Final documentation as called in the specification is to be submitted within 3 months from the date of despatch of material. In case of default, the Performance BG is liable to be en-cashed.
8.	**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 Despatch Clearance from BHEL. Supplier shall send inspection call on prescribed format (web site) only, with an advance notice of 15 days.
9.	**DESPATCH DOCUMENTS :** Following despatch documents are to be immediately sent to purchaser on despatch. - Copy of LR - Copy of delivery challan / packing list - Insurance certificate - Guarantee certificate
10.	**DELIVERY PERIOD:** Bidder to specify delivery period in weeks from the date of LOI / PO. Time for conduction of type test, if required, is to be separately indicated. Note: LR date or Invoice date whichever is later shall be considered as delivery date.
11.	**DELAYED DELIVERY:** In case of delay in execution of order beyond the lot wise contractual delivery, an amount of ½ % of total Ex-Works Value per week or part there-of subject to maximum of 5% of total Ex-Works value of P.O. will be withheld.
12.	**VALIDITY :** The offer shall be valid for 120 days from the due date of opening.
13.	**ACCEPTANCE / REJECTION OF TENDER :** BHEL reserves the right to reject in full or part, any or all tender without assigning any reason thereof. BHEL also reserves right to vary the quantities mentioned in the tender.
14.	**EVALUATION :** Comparative statement shall be prepared based on overall quantity basis unless otherwise indicated in the enquiry. Evaluation of offers shall be done on the basis of delivered cost to BHEL.
15.	**DEVIATION :** The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may load the prices for evaluation of offer with prior intimation to bidder.
16.	**ARBITRATION :** All cases of disputes emanating from and relating to this contract, the matter shall be referred to the sole arbitration of Unit Head / GM, BHEL or any other person

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	(including an employee of BHEL, even though he had to deal with the matter relating to this contract in any manner) nominated by him to act as sole arbitrator. The arbitration shall be under 'The arbitration and contract act 1996' and the rules there under as amended from time to time. The arbitrator may from time to time with the consent of the parties enlarge the time for making and publishing the award. The venue of arbitration shall be any Indian city as decided by BHEL.
17.	**LEGAL SETTLEMENT :** All suits/claims in respect of this contract shall be in the courts having jurisdiction at New Delhi
18.	**SUBCONTRACTING :** In case further subcontracting of BHEL order 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 of the responsibility of fulfilling BHEL purchase order requirements.
19.	**RISK PURCHASE :** In case the successful bidder fails to supply or fails to comply with the terms & conditions of the purchase order, BHEL reserves the right to source such material/ component / equipment/ system from any other agency at the risk and cost of the successful bidder.
20.	**ADJUSTMENT OF RECOVERY:** Any amount payable by the supplier under any of the condition of this contract shall be liable to be adjusted against any amount payable to the supplier under any other works / contract awarded to him by any BHEL unit. This is without prejudice to any other action as may be deemed fit by BHEL.
21.	**FORCE MAJEURE CONDITION:** If by reason of war, civil commotion, act of god, Government restrictions, strike, lockout which are not in control of supplier the deliveries are delayed, supplier shall not be held responsible.
22.	**MQP:** Vendor to submit approved MQP in-line with requirement of customer.
23.	BHEL reserves the right to resort for Reverse Auction to obtain best prices.
23.	**INTEGRITY PACT :** The Integrity Pact shall be issued as part of the bidding documents and shall be returned by the bidder along with the techno-commercial bid, duly signed by the authorized official of the bidder/ vendor/ contractor and authorized official of BHEL will form part of the Purchase order/ contract. 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. **Name of Independent External monitor to be considered (IEM):** **Shri Kanwarjit Singh, IRS (Rtd.)** **Address: D-6/12, Ground Floor,** **Vasant Vihar,** **New Delhi - 110 057** **E-mail address : kanwarfeb@gmail.com** This Integrity pact will be mandatory in all those cases where the estimated value of PO/Equipment is more than or equal to Rs. 10 Crores.

Signature of Bidder
Seal

BHARAT HEAVY ELECTRICALS LTD.
(TRANSMISSION BUSINESS GROUP)

TERMS & CONDITIONS FOR INSTALLATION SEVICES

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

Sl. No.	Terms & Conditions (Enquiry No. 332E255 Dated 6.10.12)
1.0	**SCOPE OF WORK:**
	The scope of work of the successful tenderer shall comprise but not limited to the following:
1.1	Receipt of equipment / material at site, unloading, handling, transportation to storage area.
1.2	Inspection/ verification of equipment/ materials received for any shortage/ damage after opening the packing cases and intimating the same to BHEL/ Owner and underwriters within the time period specified by BHEL and to strictly follow the procedures specified. Storage of equipment indoor / open stores in line with the instruction of the BHEL.
1.3	Conservation/ maintenance/ upkeep of the equipment in the store.
1.4	Temporary lighting in stores and construction area wherever required for their work.
1.5	Safety/ Security of equipments/ materials.
1.6	Transportation of equipment/ materials from stores to erection site, erection of equipment/ materials in line with the drawings/ instructions to be furnished by BHEL, testing and commissioning and handing over.
1.7	Maintenance of associated equipment till handing over, any other activity necessary for completion of the job but not specifically mentioned in this specification.
1.8	Unloading/ Transportation/ Storing/ Up keeping and handing over of spare items/ equipment.
2.0	**TESTING AND COMMISSIONING :**
2.1	All the electrical / mechanical test of the materials and equipment shall be arranged by the contractor as per standard specification / Field Quality Plan / Erection Manual / Directive of the Site Engineer/ and Owner. The contractor shall fill the check list for storage, erection, testing and commissioning of all their equipment as per BHEL systems to ensure proper quality of work.
2.2	All the testing equipment required to carry out the site test for all their equipment or the erected equipment shall be arranged by the contractor at his own cost. However, necessary instructions and guidelines will be given by BHEL/Owner.
2.3	The contractor shall be completely responsible for the satisfactory erection and providing test equipment and skilled manpower for testing, commissioning of all equipment.
2.4	Before charging, the system shall have to be approved by Statutory Govt. Authorities like Electrical Inspector, other concerned agency and the contractor has to arrange approval for the same.

SL. No.	Terms & Conditions (Enquiry No. 332E255 Dated 6.10.12)
3.0	**CONSUMABLES:**
3.1	The contractor shall provide adequate inventory of necessary consumables at Site prior to erection so that timely completion of the works under the contract is not held up due to non availability of spares/ consumables.
4.0	**COMMENCEMENT OF WORK:**
	Project start / zero date for this work shall be issue date of letter of intent or as specified in P.O.
5.0	**COMPLETION SCHEDULE:**
5.1	The entire work under this tender is required to be completed as specified in NIT / Enquiry.
6.0	**OVER RUN CHARGES:**
6.1	No over run charges are payable.
7.0	**IDLE LABOUR CHARGES:**
7.1	No idle labour charges will be admissible in the event of any stoppage of work resulting in the contractor's workmen being rendered idle due to any reason at any time.
8.0	**SECURITY-CUM-PERFORMANCE GUARANTEE:**
8.1	The contractor shall furnish security-cum-performance BG for 10% of total contract value within two weeks of placement of work order valid till guarantee period on a non-judicial stamp paper of appropriate value from a nationalised bank or any scheduled bank as per RBI guidelines (excluding cooperative bank) in the prescribed format . The BG should be sent directly by your banker to us.
9.0	**INSURANCE:**
9.1	The Contractor shall take insurance cover(s) to cover his Tools and Plant assets, workman compensation and third party liability. The contractor shall make available the original insurance cover(s) to the Engineer for necessary verification before commencement of work.
10.0	**QUANTITY VARIATION**:
10.1	In case of item rate contract, the contract value is subject to variation based on the actual quantity executed within $\pm$ 30%. Quantities of individual items may vary to any extent or may get deleted. No compensation is payable due to variation in quantity. If the work is to be executed on "Lumpsum" basis for the Package, no variation of contract value shall be admissible to the contractor within the scope of contract, as long as the inputs remain unchanged. In case of change in scope after award of the contract, the additions/ deletions to the scope shall be settled at mutually agreed rates.
11.0	**GUARANTEE:**
11.1	Though the work will be carried out under the supervision of BHEL Engineers, the contractor shall be responsible for the quality of the workmanship and shall guarantee the work done for a period of 15 months from the date of putting the complete system into commercial operation or 18 months from the date the system is declared completely erected, duly tested and accepted by customer, whichever is later and shall rectify free of cost all defects due to faulty erection detected during the guarantee period starting from the date of the completion of rectification. In the event of the contractor failing to repair the defective works within the time specified by the engineer, BHEL may proceed to undertake the repairs of such defective works at the contractor's risk and cost without prejudice to any other rights under the contract and recover the same from security deposit/ other dues of this project or any other project executed by the contractor.

Sl No.	Terms & Conditions (Enquiry No. 332E255 Dated 6.10.12)
12.0	**TERMS OF PAYMENT:** The terms of payment shall be as under unless specified elsewhere.
12.1	No mobilisation advance is payable
12.2	70% of the contract price on the monthly progressive bills on pro-rata basis for the unloading, storage and erection work completed as certified by BHEL, Engineer.
12.3	20% after testing of equipments on pro-rata basis & completion of satisfactory commissioning.
12.4	10% of the contract price after acceptance test, retest if any, PG Test and handing over.
12.5	The payment due to the contractor shall be released after deducting income tax wherever deductible at source as per Indian. Income tax act and BHEL will issue appropriate certificate to the contractor after tax deduction.
12.6	All taxes including sales tax, works tax, service tax etc., if any shall be to the contractor's account. All charges on account of Octroi, Terminal tax and / or other duties on materials obtained for the work shall be borne by the contractor.
13.0	**ESCALATION / PRICE VARIATION:**
13.1	Prices shall be firm for total contract period and extended period, if any, and no price escalation / price variation will be applicable.
14.0	**COMPENSATION FOR DELAY IN EXECUTION:**
14.1	In case the contractor fails to complete the work within the time specified or any extension thereof subject to force major condition, the contractor shall be liable to pay by way of compensation, a sum equal to half percent (½%) of the contract price, per calendar week or part thereof by which the commissioning is delayed, subject to a ceiling of 10% of the contract price.
15.0	**FACILITIES TO BE PROVIDED AT SITE BY THE CONTRACTOR:**
15.1	Watch and ward for the stores and safe custody of the equipment in the scope of Contractor shall be their responsibility.
15.2	It is the responsibility of the contractor to dismantle and take away all the materials of his office accommodation as soon as the work is handed over to BHEL/Owner and clean the area of debris.
16.0	**ADDITIONAL EXPENDITURE:**
16.1	In case any additional expenditure is incurred in the works arising out of the faulty execution of the works by the contractor, such additional expenditure shall be borne by the contractor.
17.0	**REGULATION OF LOCAL AUTHORITIES AND STATUS :**
17.1	The contractor shall comply with all state and central laws, statutory rules, regulations etc., such as : The payment of wages to, the minimum wages Act. The workmen compensation Act., The employees liability Act., The industrial dispute Act., the employees provident fund Act., Employees state insurance scheme, The contract labour (regulation & abolition) Act 1970 and other Acts, Rules and regulations for labour as may be enacted by the Government during the tenure of the contract and having in force or jurisdiction at site. The contractor shall given to the local Governing Body, Police and other concerned Authorities all such notice as may be required under law.

Sl. No.	Terms & Conditions (Enquiry No. 332E255 Dated 6.10.12)
17.2	The contractor, as required, will obtain independent license under the contract labour (Regulations and Abolition) Act. 1970 from the concerned authorities based on the certificate (Form-V) issued by the principal Employer/ Customer.
17.3	The contractor shall pay all taxes, fees, license charges deposits, duties, tolls, royalty, commissions or other charges which may be leviable on account of any of his operations connected with this contract. In case BHEL is forced to make any of such payments, BHEL shall recover the same from the contractor either from moneys due to him or otherwise as deemed fit.
18.0	**DISCIPLINE OF WORKMEN:**
18.1	The contractor shall adhere to the disciplinary procedure set by the owner in respect of his employees and workman at site.
19.0	**ELECTRICITY &WATER:**
19.1	Electricity for construction work shall be provided at one point on free of cost basis. The contractor shall have to make their own arrangements for distribution to various locations for their works including proper switch/fuse units, distribution boards, cables poles etc. to ensure safety of men and equipment. If required the contractor shall employ diesel operative equipment in addition to electric operated ones to ensure timely completion of work.
19.2	Unless stated otherwise, the contractor shall make his own adequate arrangement for procuring clear water to be used in various works.
20.1	**FORCE MAJEURE:**
20.2	The following shall amount to force majeure conditions: Acts of God, Act of any Government, war, sabotage, riots, civil commotion, Police action, revolution, flood, fire, cyclone, earthquake, epidemic and other similar causes, over which the contractor has no control.
21.0	**ARBITRATION:**
21.1	In case of any dispute, a sole arbitrator will be appointed by BHEL and whose decision would be final and binding on both the parties. The place of arbitration shall be any Indian city as decided by BHEL.
22.	**VALIDITY OF OFFER:**
22.1	The offer shall be valid for **120 days** from the date of opening.

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

Signature of Supplier
With seal

Enquiry No. 332E255 Dtd:6.10.12

SCHEDULE OF COMMERCIAL DEVIATION

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

SL. NO.	CLAUSE NO. OF GENERAL TERMS AND CONDITION	STATEMENT OF 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 General Terms and Conditions.
- If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

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

Signature of the authorized representative of

Place: - ……

Bidder's name:……

Date: - ……

Designation……

Company Seal:……

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations/ variations exception from the Specification:

SECTION	CLAUSE NO. / PAGE NO.	STATEMENT OF DEVIATION/ VARIATIONS/EXCEPTIONS

- 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 General Terms and Conditions.
- If there is NIL deviation, even then the format to be filled as NIL DEVIATION.

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

Signature of the authorized representative of

Place: - ……

Bidder's Name :……

Date: - ……

Designation:……

Company Seal:……

ACTIVITY SCHEDULE

(SEPARATE ACTIVITY SCHEDULE TO BE FILLED-UP FOR EACH PROJECT BY THE SUPPLIER)

Sl. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS	CUMULATIVE TIME IN WEEKS FROM LOI / PO DATE	REMARKS IF ANY
1.	Submission of Documents necessary for getting manufacturing clearance like Drawings, Date sheet etc.			
2.	Approval of documents from BHEL / Customer *			
3.	Manufacturing time			
4.	Inspection call			
5.	Customer Inspection & Despatch Clearance			
6.	Arrangement for Dispatch			

Note: 1) * 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.

2) Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.

3) Qty. to be offered for Inspection should be in accordance within Delivery- schedule - lot BHEL reserves the right not to entertain multiple inspection calls for a Delivery- lot and delay on this account shall be the responsibility of Supplier.

Signature of Supplier
Dat

SCHEDULE OF PRICE

(BIDDERS TO STRICTLY ENSURE SUBMITTING THE PRICE BIDS IN THIS FORMAT)

NOTE: THIS FORMAT IS TO BE SUBMITTED IN ORIGINAL ONLY, DULY FILLED IN. REPRODUCTION OF THIS FORMAT ON BIDDER'S LETTER HEAD OR ON OTHER PAPER IS NOT ACCEPTABLE.

TENDER ENQUIRY NO. 332E255 : dtd 06.10.12

SL. NO.	DESCRIPTION OF ITEM	UNIT	Total Qunatity	UNIT PRICE EX. WORKS (Rs.)	TOTAL EX. WORKS (5 * 4)	UNIT FREIGHT & INSURANCE	TOTAL F & I (7 * 4)	* ED @ …….% OF COL 6	CST / VAT @ ...% OF COL 6+9 (6 + 9)	Unit ETC	Total ETC	Service tax@------- %of COL12	TOTAL F.O.R. DESTINATION PRICE (Rs.) (6+8+9+10+12+13)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Illumination Equipment: Illumination System as per Technical Specification TB-343-558-033 Rev 01	LOT	1										
									Total				

NOTE 1. PLEASE NOTE THAT UNPRICED COPY OF PRICE BID (i.e. WITH ALL PRICES BLANKED) SHALL BE FURNISHED ALONG WITH TECHNO-COMMERCIAL BID.
2. REQUIRED COPIES OF FORMAT BE MADE & DETAILS MAY BE ANNEXED.
3. THE PRICES MUST BE QUOTED IN THE PRESCRIBED UNIT ONLY.
4. SALES TAX RATE AS APPLICABLE FOR SPECIFIED DESTINATION SHALL BE QUOTED. IN CASE OF CST, RATE AGAINST "C" FORM SHALL BE QUOTED.
5. IN CASE OF VARIED ED SLAB RATES, CONFIRM YOUR OPTION FOR "X" OR "Y". (STRIKE OFF WHICH IS NOT APPLICABLE)
IF NO OPTION IS MENTIONED "X" SHALL BE TAKEN.
6. THE VENDORS MUST INDICATE THE APPLICABLE TARIFF NOS. UNDER WHICH ED AND / OR CST WOULD BE PAID BY THEM TO THE TAX AUTHORITIES.
7. IF A VENDOR SUBMITS AN OFFER WITH REDUCED ED AND OR CST APPLICABLE THAN NORMALLY PAID ON SUCH ITEMS, THEY SHOULD SUBMIT NECESSARY DOCUMENTARY PROOF FOR THE SAME.
"X" THE MAXIMUM ED SLAB RATE BE CONSIDERED FOR PRICE COMPARISON.
IN THE EVENT OF ORDER ED AT ACTUAL BE PAID.

"Y" THE QUOTED ED RATE BE CONSIDERED FOR PRICE COMPARISON.
IN THE EVENT OF ORDER ED AT ACTUAL RATE LIMITED TO QUOTED RATE BE PAID.

Note 1: Kindly mention the rate of all applicable taxes and duties (ED & CST/VAT) in both price and un-priced bid.
Note 2 : Also refer technical specification No TB-343-558-033,Rev01 for details.

SIGNATURE & SEAL OF TENDERER

SCHEDULE OF PRICE (For Foreign vendors only) (Part II)

Unpriced price bid to be kept with Techno-commercial offer. **Price bid should be kept in separate sealed cover.**

ENQUIRY NO: 332E255, Dtd: 06.10.12

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Name of item	Tariff No.	Qty	Unit-CIF {Indian Sea port)}	Total -CIF {Indian Sea port)}.	Break up of CIF(Indian 'Any' Sea port) rates						Breakup of Inland Transportation							
						Unit -FOB (Load port).	Total -FOB (Load port).	Unit-Sea Freight (upto indian Discharge port)	Total-Sea Freight (upto indian Discharge port)	Unit-Insurance(upto indian Discharge port)	Total-Insurance(upto indian Discharge port)	Unit-Freight (from Indian Discharge port to site)	Unit-Insurance (from Indian Discharge port to site)	Total-Freight (from Indian Discharge port to site)	Total-Insurance (from Indian Discharge port to site)	Unit ETC	Total ETC	Service tax@------- %of COL12	TOTAL F.O.R. DESTINATION
1	Illumination Equipment: Illumination System as per Technical Specification TB-343-558-033 Rev 01																		
	Total																		

NOTE-

Discharge Port:- Indian Sea Port (Any Indian port)

CIF (indian port) should be equal to "FOB(load port) + Sea Freight (upto indian Sea port) +Insurance(upto Indian Sea port)"

Load port to be mentioned by bidder .

No of package with Dimensions and type of cargo(/Break Bulk/LCL/FCL) and no. of container (with type of container) required-Is also to be mentioned by bidder.

Vendor has to mention tarrif no. against each item for custom duty purpose.

Bidder has to mention quoted (in each cell) in unpriced price bid

Enq No – 332E255 Dtd 06.10.12

PQR Open Tender

Illumination system

(1) Bidder should have successfully executed Illumination System for at-least one HVDC project.

(2) Bidder should be approved by POWERGRID. In case Bidder is not already approved, Bidder is required to obtain POWERGRID approval before price bid is opened. As per the requirements of the project, it is mandatory for the vendor to submit requisite details as well as a self assessment report covering all the 16 points given below (to the extent available) to POWERGRID :

1. Registration / License of the works
2. Evidence that the proposed sub-vendor is manufacturer of the item.
3. Organization chart with name and qualification of key persons.
4. List of Plant and Machinery.
5. List of testing equipment to carry out all the routine tests in-house along with their calibration status.
6. List of Raw material, bought out items with sourcing details.
7. List of supplies made to other utilities in last three years.
8. Third party approval, if any (viz. ISO, BIS).
9. Copy of Quality Manual (if ISO certified).
10. Pollution clearance wherever applicable.
11. Sanctioned load and Backup power/Shed area/Storage area.
12. Formats for RM, in process and acceptance testing.
13. Type test approvals conducted in last 5 years, if applicable.
14. Performance Certificates from Customers.
15. Company Brochure/ Product Catalogues.
16. Photographs of factory, plant and machinery & testing facilities.

The vendor will be required to take POWERGRID approval (independent from BHEL) based on the above assessment report within 6 weeks, to be considered for further tendering process. Any cost incurred on account of a physical assessment conducted by POWERGRID, if required, will be borne by the vendor only.

If the Vendor is unable to get the approval from POWERGRID within 6 weeks of date of receipt of NIT at their end, they will be disqualified from the bidding process without further notice.

UNDERTAKING by Vendors/Contractors for HVDC-NE AGRA project

(± 800kV, 6000MW HVDC Multi Terminal System Package associated with North East/Eastern Region – Northern / Western Region Interconnector – I Project (C-61901R-S056-8))

a) **Bribery and Corruption**:-- We represent and warrant that we will not directly or indirectly make any payment, gift or other commitment to BHEL, to government officials or to agents, directors and employees of BHEL, ABB, POWERGRID or any other party associated with this project in a manner contrary to applicable laws and shall comply with all relevant laws, regulations, ordinances and rules regarding bribery and corruption.

b) **Confidentiality**:-- We undertake to keep confidential all written and verbal information received from BHEL /POWERGRID in connection with this project. Further, we undertake that the written and verbal information (data, drawings etc) received from BHEL in connection to this project shall not be used for any purpose other than for the purpose of supply or services for this project for which it is intended.

The above undertaking does not however apply to the information which -

-- through no fault of receiving Party, is or comes in public domain through publication or otherwise, or

-- the receiving Party can establish that the information was in its possession, without any restrictions to its disclosure, at the time of its receipt.

-- is subsequently lawfully acquired by the receiving Party independent of this project

-- receiving Party is required to disclose to comply with applicable law, rule, regulation or court order or other Compulsory process of a court or other government body.

We understand that in the event of non-compliance of clauses a) and / or b) above, M/s BHEL reserves the right to terminate the Purchase Order / Contract Agreement placed on us for the above package after due notice and forfeit Security Deposit, black list or debar us from any contract with your organization for the period as deemed fit by BHEL and recover the loss, damages, cost of expenses incurred in getting the balance work/balance supplies done through other agencies. We also understand unambiguously that we will require all our sub-vendors and sub-contractors for this project (as applicable) to strictly adhere to these provisions.

Place

Date

(Authorized Signatory of Vendor / Contractor with Seal)

"In the name and on behalf of the Company's CEO"

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

_____

_____

_____. 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 Independent External Monitor(s), 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. He commits himself to observe the following principles during his 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 IPC/ PC 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 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.

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 Bidders(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines for Suspension 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 prior to the award 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 has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 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.

Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to demand from his sub-contractors a commitment consistent with this Integrity Pact. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal.

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

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

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

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 Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is 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 Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.

8.4 The Principal will provide to the Monitor 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 Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or

take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

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

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC 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 Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

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

Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement 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 agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

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

Place----------

Date----------

Witness: _____	Witness: _____
(Name & Address) _____	(Name & Address)_____
_____	_____

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-343-558-033	Rev. No.	01		Prepared	Checked	Approved
TYPE OF DOC.	**TECHNICAL SPECIFICATION**			SIGN			
TITLE	**Illumination System**			NAME	**NK**	**AKD**	**AG**
				DATE	19.07.12	19.07.12	19.07.12
				GROUP	**TBEM**	W.O. No	**80014**
CUSTOMER	**Power Grid Corporation of India Ltd**						
PROJECT	**±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR INTERCONNECTOR-I PROJECT**						
CA NO.	**C-61901R-S056-8/CA-II/3660 dated 22.12.2011 for on shore Supplies & C-61901R-S056-8/CA-IV/3662 dated 22.12.2011 for Services**						
STATION	**Agra**						

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
01	01.09.12	NK	AKD	AG	As per POWERGRID's comments received vide letter no. C/ENGG/HVDC/NER-NR/217/640 dtd 16/08/2012.

Distribution	To	TBEM	TBMM	TBQM	Vendor
	Copies	1	1	1	4

SECTION - I

Scope, Quantities and Specific Technical Requirements

1.1 Scope

This technical specification covers the requirements of design, manufacture, supply, testing at works, packing, transportation & ETC of Illumination System equipments.

Bidders shall quote for the complete illumination system including outdoor, indoor and street lighting on **LUMPSUM** basis for ±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR INTERCONNECTOR-I PROJECT as follows:

Package-I a): Complete Illumination system pertaining to Agra HVDC Multi Terminal Station **including fences/boundary** surrounding the station (as indicated in the enclosed drawing)

Package- I b): Complete Illumination system pertaining to 400/220kV Agra AC Switchyard **including fences/boundary** surrounding the station (as indicated in the enclosed drawing)

Sl. No.	Items
BB. II. A.23	**Illumination System for Agra HVDC terminal station (Bipole-I)**
BB. II. A.23.1	Indoor Illumination
BB. II. A.23.2	Outdoor Switchyard Lighting
BB. II. A.23.3	Outdoor Street Lighting
BB. II. E.14	**Illumination System for 400/220kV Agra AC Switchyard**
BB. II. E.14.1	Outdoor Switchyard Lighting
CC.II.A. 23	**Illumination System for Agra HVDC terminal station (Bipole-II)**
CC.II.A. 23.1	Indoor Illumination

The scope of illumination system shall include MLDB, panels, receptacles, luminaries, fixtures, lighting poles, lighting masts, sockets, wires, switchboard for ARB/FRB building (sketch provided in the specification), aviation light (if required as per ICAO guidelines) and other materials as mentioned in this and various other sections of this specification for complete illumination system.

1

Illumination system should be properly designed to meet the specified requirements in the sub-sequent clauses of this specification to the satisfaction of Owner/purchaser. To fulfil the aesthetic requirements few decorative light fittings shall be provided by the bidder in the strategic locations.

The contract shall be on lump-sum basis for the packages. Within the scope of the contract, no variation shall be admissible to the contractor so far the input remains unchanged. In case of variations due to unforeseen changes in scope during contract stage, the additions/ deletions to the scope shall be settled on the basis of unit rates. Hence unit rates are to be furnished by the bidders for each item in their respective bids.

1.2 Spare Parts

No spares parts are considered for illumination system for this package.

1.3 Terminology

The following terminology shall be applicable for the purpose of interpreting the relevant clauses of the specification

Project title	±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR INTERCONNECTOR-I PROJECT
Owner	Power Grid Corporation of India Limited

1.4 Qualifying requirements

Bidder should have successfully executed Illumination system for at-least one HVDC Project.

1.5 Lighting System

The lighting system shall comprise of following:

a) Main lighting from normal ac supply

This shall be provided in all areas of the station including yard (shaded area marked in the enclosed drawing) to achieve the specified illumination levels. This system shall consist of 415/240 V lighting panel boards, supplied by the 415 V station MCC. The lighting circuits shall be 240 V or 415 V. Main Lighting Distribution Boards (MLDB) for outdoor (including street lighting) and indoor along-with suitable Lighting transformers (short circuit rating 50kA for 1sec.) of suitable size to be provided to accommodate lighting load (pole basis) for each bi-pole system as much as possible as detailed in sub-sequent clauses of this specification. Powergrid shall provide the

1

required feeders from the existing lighting board kept in the existing control room for 400/220kV Agra AC Switchyard lighting.

b) Emergency AC lighting

Emergency AC lighting shall be provided in outdoor switchyard to insure personnel to safely move about in the event of failure of the normal AC lighting. It shall be supplied by CNG generators (already available) through suitable emergency lighting board (bidder to provide). Approximately 20% of normal ac luminaries shall be wired from emergency ac lighting panels. Emergency Lighting Distribution Board (EMLDB) along-with suitable Lighting transformer to be provided as detailed in sub-sequent clauses of this specification.

c) Emergency DC lighting

It shall be supplied from 220 V dc station batteries. In the event of failure of ac lighting, dc lighting shall come into operation automatically. This will provide safe passage for personnel to safely move about in the event of failure of ac lighting. The following areas shall be provided with emergency dc lighting; control room, battery room, station entrance gates, CNG generator building, Valve halls, DC Hall, Aux. LV/MV building, pump house and ARB/FRB building.

1

d) A certain number of CFL (Compact Fluorescent Light) fittings supplied from UPS shall also be provided in passages, lobbies and stairs.

1.6 Requirements of Illumination Levels

Average maintained illumination levels for different areas shall be provided as given below. For areas other than the following, illumination levels shall be as per the relevant Indian Standards:

a) Outdoor switchyard

Equipment and working area:	30 lux
Non Working Areas :	22 lux

These illumination levels shall be achieved at 2 metres from gravel level. Uniformity ratio (minimum/average) shall not be less than 0.25.

Outdoor switchyard shall be illuminated by high pressure Sodium Vapour lamps mounted on lightning masts and switchyard structures. However, additional structure/ masts/poles specifically required for lighting purposes shall be included in the scope of the Contractor. The contractor shall supply and install tubular flood lighting masts with arrangement of

fixing multiple lighting fixtures as required for areas in the AC and DC yard. The height of the tubular lighting Masts shall be decided (during contract stage) based on the average Lux level specified for different outdoor areas. Mounting height of floodlight on the masts shall be kept at one level in the outdoor areas.

b) Roads

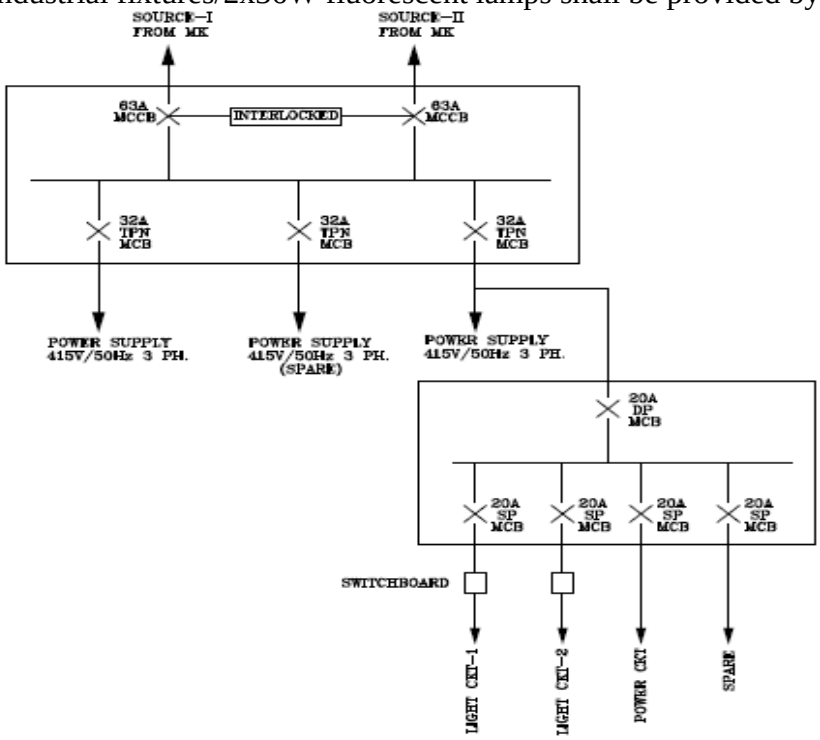
Service Roads:	30 lux
Other Roads:	20 lux

Service roads shall include approach road to the station and road around the converter building.

c) Buildings: 200 lux

Buildings include Additional Service buildings, Aux. Building, Valve hall, DC hall, Valve hall ventilation room, DC hall ventilation room, Valve cooling room, ARB/FRB buildings, Pump house, CNG building, Car parking and guard hut.

For Valve hall and DC hall high bay lighting fixture with metal halide lamps and fully enclosed IP-42 fluorescent lighting fixture shall be provided by the bidder. In other buildings Industrial fixtures/2x36W fluorescent lamps shall be provided by the bidder.



Sketch for wall mounted/panel mounted switchboard for ARB/FRB

1 no. wall mounted or panel mounted switchboard is to be supplied by the bidder for each Aux. Relay Building (ARB)/ Filter Relay Building (FRB) as per above sketch. The power supply to the panel shall be fed from the nearest available marshalling kiosk (MK).

d) Control rooms, telecommunication rooms, Conference room, offices, workshops, first aid rooms: 350 lux

Control room shall be illuminated with recessed type decorative fluorescent luminaries with 2x36 watt lamps/CFL.

e) Other rooms 150 lux

In other rooms Industrial fixtures/2x36W fluorescent lamps shall be provided by the bidder

1.7 Illumination design criteria

The Bidder shall determine the number of luminaries to be installed based on calculations to prove that the installation complies with the illumination levels specified in clause 1.6. The Contractor shall also measure actual lux level in all the areas as executed to confirm that specified levels have been met.

The levels specified are the design figures and do not include an allowance for aging and utilisation factors. These factors shall have to be taken into account while designing lighting system. A maintenance factor of 0.7 shall be used for outdoor areas and 0.8 for indoor areas.

The reflection factors for wall, ceiling & floor shall be adopted based on the finish schedules. Working plane height shall be considered at finished floor level except for the office spaces where it shall be 0.85 m above F.F.L. The Contractor shall submit the calculation to prove that glare is within limits as per the applicable standards for normal finished walls as well as metallic finished walls. Wherever necessary, high end mirror optic glare free fixtures shall be provided.

The Contractor shall also submit the calculation for uniformity ratio of outdoor yard illumination to the Employer/Purchaser for approval.

1.8 Lighting system requirements

a) On failure of normal ac supply, the luminaries connected to the dc systems shall be

automatically switched ON. Within few seconds of starting the CNG generators the dc emergency lights shall be automatically switched off and the ac emergency supply shall be made available to the ac emergency lighting system. When the station service supply is resumed the entire lighting system shall be fed from normal ac supply. In the event of failure of both normal ac supplies and emergency ac supply, the luminaries connected to the emergency dc shall remain illuminated.

b) The lighting layout shall be coordinated with air conditioning and ventilation ducts, diffusers etc. and suitable layouts shall have to be arrived at by the lighting Contractor. All wiring in rooms and area where air conditioning has been provided shall have concealed wiring. Wiring shall be concealed below false ceiling. Concealed wirings in conduits have been envisaged except DC hall & Valve hall. For Valve hall and DC hall where high bay fixtures shall be used, the conduit/cable shall be surface mounted and cable trays with cover shall be fixed on the truss available in the building. The cable/conduits shall be exposed behind the cladding. The supports required for the cabling and high bay fixtures shall be provided by the bidder. Lighting system layouts shall be finalised keeping in view the other services coming in the areas. Also the total voltage drop from ac lighting distribution board to luminaries shall be limited to 5%. 1

c) The type of luminaries selected and their mounting positions shall not cause excessive glare. The lighting equipment shall not produce any UV rays in valve halls. CFL light fittings shall be used at various locations which shall be finalised during detailed engineering.

d) Provision shall be provided for controlling the Valve hall and DC hall lighting from the station control room. The high bay luminaries hung from ceiling shall not project beyond GI wire mesh/GI sheet screen provided in ceiling of valve hall. 1

e) Control room shall be illuminated with recessed type decorative fluorescent luminaries with CFL/2x36 watt lamps. The luminaries shall be suitable for mounting in continuous rows and arranged to give neat appearance.

f) Outdoor switchyard shall be illuminated by high pressure Sodium Vapour lamps mounted on lightning masts and switchyard structures. However, additional structure/ masts/poles specifically required for lighting purposes shall be included in the scope of the Contractor. Clearances required from the live parts shall be kept in view by the Contractor while deciding floodlight locations.

g) Switchyard lighting shall be controlled by the Building Management System (BMS) (not in scope of the bidder, however additional necessary contacts in distribution boards/panels to be provided by the bidder) as well as manually. Provision shall

include for controlling the switchyard lighting from the control room. Lighting distribution in yard shall be done through distribution boards/panels located outdoor in yard at load centers.

h) Roads from boundary gates to service buildings shall be lighted by use of street lighting poles with street light illuminated with flood lights as part of switchyard. High pressure Sodium vapour lamps of appropriate wattage shall be used. High power factor regulating type ballasts shall be used. Road lighting shall be controlled through the BMS as well as manually (up to distribution board level). The service road is shown in the enclosed layout drawing. Please refer clause no. 2.23 of this specification.

i) All lighting fixtures shall be approved by the Employer.

1.9 Sockets

To reinforce lighting level during maintenance, receptacles shall be provided in the switchyard and buildings, for portable lights. The sockets shall also be used for the purpose of vacuum cleaning, power supply to instruments, etc.

240 V, single phase, 5 pin, 5A / 15A duplex switch sockets shall be provided along the indoor surface of the walls of the building at every 5 metres of wall length (min. 2 nos. in each room). 1

240 V, single phase, duplex switch sockets outdoor type, shall be provided along the outdoor surface of the walls of the building;

415 V, 3 phase, 5 pin, 32A sockets shall be provided where required, at least one per room or area, two per workshop, 2 nos. per valve hall and 4 nos. per DC hall. Also, 2 nos. 415V, 3-phase, 5 pin, 63A sockets shall be provided per DC hall. In addition to above, 2 nos. 63A receptacles to be provided in the outdoor switchyard. 1

Wall mounted panels of 415V fitted with a switch and current rating suitable for the oil handling plant (not less than 300A) shall be provided. The supply for the oil handling plant shall be taken from this panel. The panel shall be suitable for outdoor installation and termination of a 4-wire system. 2 numbers of such panels close to converter transformer shall be provided in each pole of each of the converter stations.

Degree of protection for outdoor switch sockets shall be IP55.
In addition the Contractor shall supply suitable plugs for the each type of sockets described above and provide at least one house hold type 5A/15A sockets in each room.

1.10 Points for Ventilation Fans/Exhaust Fans/Fans

Bidder shall provide points for ventilation/exhaust fans for different area such as Switchgear building, Auxiliary service rooms, Pump house, AC/DC rooms, toilets/ pantry etc. as per requirement.

1.11 Control and command for BMS

All control and command for the illumination system shall be incorporated centrally integrated with the building management system (not in bidder scope). Commands for the lighting of station building, yard lighting area etc. should be given according to time of the day and also according to weather conditions and brightness outside. The control and monitoring of illumination system shall be at lighting distribution board level.

Bidder shall ensure that Necessary control and protection functions pertaining to Illumination system are taken care and signals are brought to BMS as per Powergrid requirements.

1.12 Free Issue items provided by BHEL

The following items only shall be supplied as free-issue items:

Cables of following sizes shall be supplied by the BHEL;

i) 3.5Cx630 sq.mm Al. cable
ii) 3.5Cx400 sq.mm Al. cable
iii) 3.5Cx300 Sq.mm Al. cable
iv) 3.5Cx95 sq.mm Al. cable
v) 3.5Cx70 sq.mm Al. cable
vi) 3.5cx35 sq.mm Al. cable
vii) 4cx16 sq.mm Al. cable
viii) 4cx6 sq.mm Al. cable
ix) 2cx10 sq.mm Al. cable
x) 2Cx6 sq.mm Al. cable
xi) 2cx2.5 sq.mm Cu. Cable

b) 50x6 sq.mm GI flat shall be supplied by BHEL
c) Cable trays shall be supplied by BHEL

1

Other earthing material/conduits (GI/MS/PVC/Hume for buried cable also)/fixing hardwares etc. shall be supplied by the bidder.

SECTION – II
EQUIPMENT SPECIFICATION

2.1 Station Lighting System

The Contractor shall design & provide the complete lighting system for complete Agra HVDC converter station and 400/220kV Agra AC Switchyard.

The lighting system shall include various lighting fixtures complete with lamps & accessories, lighting panels, lighting distribution boards receptacles & switch boards, conduits, cables & wiring, junction boxes, pull out boxes, lighting poles and structures, battery/dc operated fluorescent lamps & fixtures, like materials, as required.

The lighting system load shall be supplied from 415 V main LVAC board and shall feed lighting distribution boards incorporating transformers. Each shall have adequate number of outgoing feeder controlled by MCB's. Each outgoing feeder shall feed a lighting panel having 12 or 18 ways and suitably located which shall control the lights in a particular area. The dc supply to dc emergency lighting panel shall be made available from the dc distribution board.

All wiring in rooms and areas where air conditioning has been provided shall have concealed wiring.

Mounting height for panels, board, socket, switches, etc. shall be as follows

Sockets in control room, conference room, offices, communication room etc.	450 mm above FFL
Local switch boxes	1500 mm above FFL.
Lighting DBS	Floor mounted.
Lighting panels	From FFL to top 2000 mm.

The on-off control of lighting system shall be automatic as well as "manual". Automatic lighting shall be controlled through the building management system (BMS).

A diagram or schedule shall be prepared for fixing to the inside cover of every distribution board and panel giving details of the points controlled by each circuit. The lists shall be mounted on the inside of the cover door and shall be protected by an

acrylic sheet slit into a metal frame over the circuit list and cover to be easily removable to permit circuit modifications.

2.2 Lighting fixtures and accessories

All lighting fixtures and accessories shall be designed for continuous operation under atmospheric conditions existing at site, without reduction in the life or without any deterioration of materials, internal wiring, etc. Lighting fixtures and accessories meant for 240 V AC operations shall be suitable for operation on 240 V AC 50 Hz, supply with supply voltage variation as specified.

Lighting fixtures and accessories shall be suitable for operation of 220 V dc with specified variation.

2.3 Conduits & conduit accessories

The Contractor shall supply and install all GI conduits including accessories required for wiring as required. The sizes of conduits to be used shall be determined by the Contractor.

The conduits shall conform to IS-1653/9537. The minimum size of conduit shall be 20 mm. Each piece of conduit shall be straight, free from blister and other defects.

Flexible conduits wherever required shall be made with bright, cold rolled annealed and electro-galvanised mild steel strips. All conduits accessories shall conform to relevant 1S and shall be hot dip galvanized.

2.4 Lighting distribution boards

The lighting distribution boards shall be of totally enclosed compartmentalised sheet steel with an approved enamelled finish, dust and vermin proof and floor mounting, indoor type, suitable for 415 V, 3 phase 4 wire, 50 Hz electrical system. Sheet steel used shall be of 2.5 mm (minimum) thick and shall have a smooth flawless surface.

Each lighting distribution board shall be provided with the following:-

a) TPN load break Isolating switch on the primary side of transformer.

b) One integrally mounted lighting power transformer.
c) TPN switch fuse unit on the secondary side of the above transformer.
d) Aluminium bus bars 3 phase and neutral with colour code to clearly indicate the phases.
e) Three indicating red lamps with fuses to indicate supply on.
f) MCCB / MCB for each of outgoing circuits.
g) Cable lugs, name plates, circuit numbers, internal wiring, earthing studs etc. to complete the cubicle.

The lighting distribution board shall be arranged in two adjacent but separate compartments. One compartment shall house the lighting transformer and isolator. The second compartment shall house outgoing feeders. Independent hinged door for access to transformer and group of outgoing feeders shall be provided at the front. The door shall be provided with suitable gasket to make the boards dust proof. Locking facility shall be provided on the door. The transformer shall be arranged such that it shall be drawn out easily for maintenance purpose.

Suitable ventilation arrangements shall be provided in the lighting distribution board to dissipate the heat of the transformer. The arrangement shall be in form of louvers and the same shall be provided with galvanised wire mesh/to make them dust and vermin proof. The metal Cubicle shall be provided with a suitable number of knockouts for cable entries and 2 numbers of ground studs.

Each current carrying component shall be so designed that under continuous rated full load conditions & in the climatic conditions at site the maximum total temperature permitted under the relevant regulations is not exceeded.

Neutral bar shall have the appropriate number of ways, relative to the size of the board.

The metal surface adjacent to any live part and all spaces between phases shall be protected by barriers of fireproof insulating material.

The current rating of the bus bars in each distribution board shall be adequate. The degree of protection of board shall be IP42.

2.5 Lighting panels

Lighting panels shall be totally enclosed sheet steel, indoor, vermin proof, Cabinet type, capable of being mounted against wall, column of structure or flush

mounting. Sheet steel used shall be 2.0 mm (minimum) thick and be smooth and flawless. Hinged doors with gaskets shall be provided for access to the switches. The panel shall be given one coat of red oxide primer and two coats of anti-corrosive paint. Panels to be located outdoor shall have a degree of protection of IP55 and those located inside shall have a degree of protection of IP42.

The lighting panel shall be complete with aluminium bus bars and shall incorporate TPN iron clad isolating switch or miniature circuit breaker without overload and short circuit tripping elements on the incoming side and single pole and neutral miniature circuit breaker on the outgoing feeders. Current rating for incoming and outgoing shall be determined by the contractor.

DC Lighting panels shall comprise of one +ve & one -ve bus bar air insulated metal clad suitable for wall mounting and incorporating air break manually operated quick make, quick break fuse switches on incoming side.

Each lighting panel shall be fitted with two GI earth studs located in an accessible position on the outside of the board. All metal parts of the panel except current carrying parts shall be bonded together electrically and to the earth bus bar.

Each panel shall be fitted with a card index of circuits on the inside of front cover.

2.6 Lighting Masts & Street Lighting

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The contractor shall supply and install GI tubular flood lighting masts (with raising and lowering facility) with arrangement of fixing multiple lighting fixtures as required for areas in the AC and DC yard. The height of the tubular lighting mast shall be decided (during contract stage) based on the average Lux level specified for different outdoor areas.

The lighting pole shall be welded steel tubular pole 410 SP32 as per IS 2713 (Part III). The exposed outside surface shall be coated with two coats of red oxide primer & zinc chromate in a synthetic medium. Embedded portion shall be coated with bituminous preservatives. The galvanised Sheet Steel Junction Box for the street lighting poles shall be completely weather proof conforming to IP55 and provided with a lockable door and HRC fuse mounted on a fuse carrier and fuse base assembly.

Distance of pole from street edge should be approximately 1000 to 1200 mm. Earthing of the poles should be connected to the switchyard main earth mat.

2.7 Lighting wires

Lighting cables shall be of 1100 Volt grade, aluminium conductor, PVC insulated, un-armoured and PVC sheathed. Multi-core cables shall have extruded PVC inner sheath. The cables shall be the standard products of reputed manufacturers and shall conform to Indian Standard IS-1554.

Wiring between lighting panel/fuse distribution board to junction boxes in outdoor switch-yard area shall be done by aluminium conductor, PVC insulated and PVC sheathed cables laid in trenches. Wherever trenches are not there cables shall be laid in galvanised steel pipes. Galvanised steel pipes to be supplied and installed by lighting Contractor.

Street lighting wiring shall be done by armoured cables buried underground. Wiring from junction box to flood light via control gear box and from junction box to street light shall be done by 2 core 2.5 sq. mm. stranded copper conductor.

Wiring in indoor areas such as control room, electrical room etc. shall be done by single core PVC insulated stranded copper conductor wires in galvanized steel conduits. The wires shall be 1100V grade, PVC, unsheathed single wire cable conforming to IS-694. The conductor sizes for wires used for point wiring beyond lighting panels shall be single core 4 Sq mm, 6 Sq mm and 10 Sq mm stranded aluminium wires and 2.5 Sq mm, 4 Sq mm, 6 Sq mm stranded copper wire. Separate neutral shall be run for each circuit. Number of wires to run in particular size of conduit shall be as per IS-732.

The wires shall be colour coded Red Yellow & Blue shall be used for three phase, Black for neutral & White and Grey to positive & negative.

2.8 Test and test reports

Type tests, acceptance tests and routine tests for the lighting fixtures and accessories covered by this specification shall be carried out as per the relevant standard for the respective fixtures and their accessories.

Type tests, acceptance tests and routine tests for the lighting panels shall be carried out as per relevant Indian Standard IS-8623.

All the type tests, acceptance test and routine test for the lighting transformer shall be

carried out as per IS-2026.

The Contractor shall also measure actual lux level in all the areas as executed to confirm that specified levels have been met.

2.9 Lighting system installation work

All accessories/fittings required for making the installation complete shall be supplied by the Contractor. The conduit fittings shall be of the same material as conduits. All conduits shall be embedded and surface conduits shall not be permitted. However in areas having false ceiling, surface conduits shall be permitted above the false ceiling area.

All un-armoured cables shall run within the conduits from lighting panels to lighting fixtures, receptacles etc.

Conduit supports shall be provided at an interval of 750 mm for horizontal runs and 1000 mm for vertical runs.

Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury to the inner surface of the conduit.

Spacing of embedded conduits shall not be less than 38 mm.

Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating devices etc. when it is evident that such proximity may reduce the service life of cables.

For long conduit run, pull boxes shall be provided at suitable intervals to facilitate wiring. Conduit shall be securely fastened to junction boxes or cabinets each with a lock nut inside and outside the box.

Conduit lengths shall be joined by screwed couplers. Couplers shall be cleanly cut. Conduit joints and connections shall be made thoroughly water-tight and rust proof by application of a thread compound which shall insulate the joints. White lead is suitable for application on embedded conduit and red lead for exposed conduit.

Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations of flattened surfaces. Heat shall not be applied in making any conduit bend. Separate bends may be used for this purpose.

The entire metallic conduit system shall be electrically continuous and thoroughly grounded. Where slip joints are used, suitable bonding shall be provided around the joint to ensure a continuous ground circuit.

Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be provided around the joint to ensure a continuous ground circuit.

Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.

2.10 Wiring

Pull boxes or inspection type fittings shall be used to facilitate pulling of wires. After erection, the conduits shall be tested and connected to earth.

Wiring shall be generally carried out by PVC wires in conduits. All wires in a conduit shall be drawn simultaneously. No subsequent drawing of wire is permissible.

Wires shall not be pulled through more than two equivalent 90° bends in a single conduit run. Where required, suitable junction boxes shall be used. Wiring shall be spliced only at junction boxes. For lighting fixtures, connection shall be teed off through suitable round conduit or junction box, so that the connection can be attended without taking down the fixture.

For vertical run of wires in conduit, wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.

Maximum two wires can be terminated to each way of terminal connections.

Separate neutral wires are to be provided for each circuit. AC and DC wiring shall not run through the same conduit.

2.11 Flood Lighting Posts/ Masts

The steel tubular poles/masts used for flood lighting shall be painted with two coats of aluminium paints after completion of installation.

2.12 Grounding

All lighting masts, poles, panels, junction boxes, receptacles, fixtures, conduit etc. shall be grounded in compliance with the provision of I.E. rules.

Ground connections shall be made from nearest available station ground grid.

Lighting Panels shall be directly connected to ground grid by two numbers 50 x 6 flats.

A continuous ground conductor of 16 SWG G.I. wire shall be run all along each conduit run and bonded at every 600 mm by not less than two turns of the same size of wires. The conductor shall be connected to each panel ground bus.

All junction boxes, receptacles, lighting fixtures etc. shall be connected to this 16 SWG ground conductor.

2.13 Enclosed Documents :

Agra HVDC Terminal Station

1. GA drawing Agra S/s
2. Layout Plan Agra A/C Yard
3. Section & Elevation Agra A/C Yard
4. Layout Plan 400/220kV Agra AC Switchyard
5. Section & Elevation 400/220kV Agra AC Switchyard
6. Service Building – Ground Floor Agra S/s
7. Service Building – First Floor Agra S/s
8. Service Building – Second Floor Agra S/s
9. Additional Service building layout
10. Aux. Building Layout
11. Valve Hall Plan and Elevation
12. DC Hall Plan and Elevation
13. DC Yard Plan and Elevation
14. SLD for 415V Aux. AC system (for nos. of lighting feeder)
15. Sketch showing illumination scope for Agra HVDC station

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2.14 List of Building :

1) Service Building – Ground floor

2) Service Building – First floor

3) Service Building – Second floor

4) Additional Service Building (2 nos) – Ground floor

5) Additional Service Building (2 nos) – First floor

6) Aux. Building (2 nos.) (includes 4 nos. LV Swgr room & 4 nos. MV Swgr room)

7) Valve Hall (4 nos.)

8) DC Hall (4 nos.)

9) Valve Hall Ventilation room (4 nos.)

10) Valve Cooling room (4 nos.)

11) DC Hall Ventilation room (4 nos.)

12) Pump House

11) CNG Building

12) ARB/FRB Building (17 nos.)

11) Car Parking

12) Guard Hut…etc.

SECTION – III

PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS

Please refer TB-343-316-00: General Technical Requirements- Section 3

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB-343-316-000	Rev. No.	02		Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION			SIGN			
TITLE	GENERAL TECHNICAL REQUIREMENTS-SECTION 3			NAME	NK	MK/AG	RK
				DATE	06.04.11	07.04.11	07.04.11
				GROUP	TBEM	W.O. No	80014

CUSTOMER	Powergrid Corporation of India Ltd.
PROJECT	±800KV, 6000MW, HVDC MULTI-TERMINAL NER/ER – NR/WR INTERCONNECTOR-I PROJECT
LOA NO.	C-61901R-S056-8/NOA-II/3660 dated 21.3.2011 for Supplies & C-61901R-S056-8/NOA-IV/3662 dated 21.3.2011 for Services

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS
02	20.07.11	NK	MK	AG	
01	11.07.11	NK	MK	AG	

Distribution	To	TBEM	TBMM	TBQM	Supplier
	Copies	1	1	1	4

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GENERAL TECHNICAL REQUIREMENTS-SECTION 3

3 General

The Works covered by the Specification shall be designed, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India. The Equipment(s) shall also conform to the general requirements detailed in the following standards, which shall form an integral part of the Specification, in addition to meeting the specific requirements called for elsewhere in the Specification.

The Supplier shall note that the standards mentioned herein are not mutually exclusive or complete in themselves, but are intended to complement each other, with minimum repetition, to define the requirements of the Specification. In the event of a conflict between requirements of any two clauses of the Specification/ documents or requirements of different codes/ standards specified, the more stringent requirement as per the interpretation of the owner shall apply, unless confirmed otherwise by the owner in writing based on a written request from the Supplier.

In case of conflicting requirements between this document (General Technical Requirements - Section 3) and equipment specification (Section 1 & Section 2), equipment specification shall prevail.

When specific requirements stipulated in the Specification exceed or change those required by the applicable standards, the stipulations of the Specification shall take precedence.

Unless specifically agreed to by the Purchaser prior to Award of Contract, the Work shall be in accordance with the standards indicated and the requirements of the Specification. The Supplier shall be held responsible for any deviation.

In case of conflict between the various standards, the decision of owner shall be binding & final.

3.1 Definitions

The following words and expressions shall have the meanings hereby assigned to them throughout this document

"Biswanath Chariali " means Biswanath Chariali Converter Station

"Alipurduar " means Alipurduar Converter Station

"Agra" means Agra Converter Station

"Employer/Owner" means Power Grid Corporation of India Ltd.

"Purchaser" means Bharat Heavy Electricals Limited

"Supplier/Manufacturer" means the person or persons, firm or company assigned to execute the works as defined by the scope of supply, described here.

"Specification" refers to this document.

3.2 Instructions to Suppliers

The supplier should be approved by Power Grid. If not, it is the responsibility of the vendor to be assessed and approved by Power Grid, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

The supplier shall submit the technical requirements, data and information as per the technical data sheets provided in the appropriate clause of bid document.

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 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.

The Supplier shall offer equipment whose similar equipment for similar applications have been in service for at least two years from the date of first stage bid opening (30-06-2009) and should have been type tested as per relevant standards.

The suppliers who have supplied 400 kV equipment rated for 40 kA earlier to POWERGRID, may supply 50 kA rated equipment subject to fulfilling specified requirements:

The supplier shall supply type tested (including special tests as per tech. specification) equipment and materials. The Employer shall accept the equipment type test reports under the following conditions:

(i) Type test in accordance with the relevant specified standards

(ii) Type tests performed within five (5) years from the date of first stage bid opening (30-06-2009)

(iii) The type tested equipment shall be of the same design, insulation class and rating as per the equipment offered under this contract

In the event that equipment furnished includes important modifications of, or significant departure from, the designs of equipment on which type test report has been furnished or if there is evidence that the equipment does not comply with the requirements of the Specifications, the Supplier shall conduct the type test without any cost implication to the Purchaser. In the price bid, the type test charges shall be included and no separate type test charges shall be indicated by the supplier.

Acceptance of the type test reports shall be at the discretion of the Employer. All type tests

performed after the date of award of the Contract shall be witnessed by the Employer unless authority to proceed with the tests in his absence is received from the Employer in writing.

3.3 Standards

All equipment and materials, unless otherwise specifically required in the Specification, shall conform to latest revisions of the standards listed in the Specification, in force at the time of signing of the contract for this project.

Generally the standards listed in the specification are applicable in accordance with the specific requirements of the technical section covering particular alternating current equipment or materials.

3.4 Site information

Table 3.4 - 1 Table for site information

	Particular	*Biswanath Chariali*	*Alipurduar*	*Agra*
a)	Employer/Owner	*Power Grid Corporation of India Ltd (POWERGRID)*		
b)	Project Title	*±800 kV, 6000 MW HVDC Multi terminal System Package*		
c)	Location	*70 km from Tezpur in Sonitpur district of Assam, Kolkatta port is the nearest port to the site*	*175 Kms. from Siliguri city in the state of West Bengal. Kolkatta port is the nearest port to the site*	*12.6 Km Agra-Shamsabad road PO – Shyamo, Agra*
d)	Nearest Rail Head	*Guwahati*	*Alipurduar junction*	*Agra*
e)	Postal Address	*To follow*	*To follow*	*To follow*
f)	Design ambient temp.	*40°C*	*40°C*	*50°C*
g)	SEISMIC COEFFICIENT	*Zone V Importance factor for the stations is 1.5 as per table no. 6 of IS-1893.*	*Zone IV Importance factor for the stations is 1.5 as per table no. 6 of IS-1893.*	*Zone III Importance factor for the stations is 1.5 as per table no. 6 of IS-1893.*
h)	Site Wind Pressure	*Zone V with basic wind speed of 50 m/s at 10 m height above mean ground level. The risk level coefficient/factor shall be taken as 1.07.*	*Zone IV with basic wind speed of 47 m/s at10 m height above mean ground level. The risk level coefficient/factor shall be taken as 1.07.*	*Zone III with basic wind speed of 44 m/s at 10 m height above mean ground level. The risk level coefficient/factor shall be taken as 1.07.*
i)	Isokeraunic Level	*150 days per year*	*150 days per year*	*50 days per year*
j)	Relative Humidity	*Max. 100%*		
k)	Rain fall Intensity	*In 24 hours: 250mm 80mm/hr (for drainage system Design*	*In 24 hours: 250mm 80mm/hr (for drainage system Design*	*In 24 hours: 200mm, 30mm/hr (for drainage system Design)*

3.5 Site temperatures for design purposes

The Supplier shall assume the temperatures given below for the design of the works at the converter stations.

Table 3.5 - 2 Table for Site temperatures

Description	*Temperature in deg C*		
Site	*Biswanath Chariali*	*Alipurduar*	*Agra*
Maximum dry bulb one hour average	*40*	*40*	*50*
Maximum dry bulb 24 hour average	*40*	*40*	*40*
Annual mean dry bulb temperature	*30*	*30*	*30*
Minimum dry bulb one hour average	*0*	*0*	*0*
Maximum wet bulb one hour average	*33*	*33*	*33*
Dry bulb temperature for low ambient condition	*33*	*33*	*33*
Wet bulb temperature for low ambient condition	*23*	*23*	*23*

3.6 Documentation

All technical description, specifications, literature, correspondence, prints, drawings, instruction manuals, test reports(both factory and site), progress photographs, booklets, schedules and all supplementary data or documents furnished in compliance with the requirements of the Contract, shall become the property of the Purchaser/owner and the costs shall be considered as included in the Contract price.

The Supplier shall be responsible for any time delay, misinterpretation, error and conflict during design, manufacturing, testing and erection of the Works resulting from non-compliance with the requirements of this Specification.

The Purchaser/owner shall have the right to make copies of any documents, data, reports, information etc. supplied by the Supplier in connection with the Works. The Purchaser/ owner shall not impart the information of these documents to any other manufacturer or competitor but he shall be free to use these for preparation of technical papers, reports etc.

The Supplier shall submit consolidated list of all symbols used in any drawing, data and information under three separate headings namely Civil, Mechanical & Electrical. If symbols other than IS or IEC are used, the Supplier shall submit consolidated list of these symbols and their significance under a separate section.

The Supplier is not required to supply detailed drawings whose purpose is manufacture only butin case such information is specifically asked for by the Purchaser/owner during evaluation of Bid, finalization of Contract, design review by Purchaser/owner his appointed Consultant or during execution of the Contract, the Supplier shall comply with the same.

All drawings, documents manual etc. as specified in this section shall have to be provided separately for each station.

All documentation shall be in English language.

Requirements for submission of documents, information and data by the supplier

General

The Supplier shall submit to the Owner/Purchaser all documents in accordance with an approved schedule of submissions and shall submit any further information (in the form of drawings, documents, manuals, literature, reports etc.) when asked by the Owner/Purchaser while commenting/approving any drawings/documents etc. All applicable documents shall be provided for each converter/repeater station separately.

The documents which are subject to the approval of the Owner/Purchaser shall be identified by the Supplier with the stamp "FOR APPROVAL". All other documents shall be submitted to the Owner/Purchaser for information and shall be identified by the Supplier with the stamp "FOR INFORMATION".

The sequence of submission of the documents shall be subject to the approval of the Employer. The sequence of submissions of all documents shall be such that the necessary information is available to enable the Employer to approve or comment the document.

The Supplier shall supply 5 hard copies of all drawings and documents. The final documentation for the project shall be supplied in nine sets of hard copies (three to each site) and nine sets of CDs to the Purchaser.

The entire plant documentation shall include all construction drawings, equipment specifications, design/study reports, O&M documents, factory test reports, etc. All the final/as built drawings shall be submitted in CAD format along with the complete final documentation.

In case a "SUBSEQUENT" revision of any document is made due to any reason whatsoever, a revision of the same, highlighting the changes shall be resubmitted for the Employer's specific approval/ information.

Documents for approval

Approved documents shall be considered as the working documents. However the Specification and connected documents shall prevail over these documents in case a decision is required on interpretation.

Documents for information

The Supplier shall not delay the Works pending the receipt by the supplier of the comments on documents submitted to the Owner/Purchaser for information. However, the Owner/Purchaser shall have the right to comment on all the documents submitted by the Supplier, when, in the opinion of the Owner/Purchaser the document does not comply with the Contract or otherwise. The Supplier shall satisfactorily demonstrate that the information contained in the aforesaid document does meet the requirements of the Contract or revise the document in order that the information shall comply with the requirements of the Contract.

Drawings and data

General

The Supplier shall submit to the Owner/Purchaser all assembly and detail drawings of equipment,

station design, civil work, building, controls, protection, etc., as well as the corresponding computation where necessary in order to establish to the satisfaction of the Owner/Purchaser the Supplier's compliance with the requirements of the Contract.

Drawings, as set forth below shall be submitted to the Owner/Purchaser and shall be completewith all information necessary for complete interpretation of the drawings by the Owner/ Purchaser. All drawings shall show the materials, dimensions, finish, fits, clearances, tolerances, bolting and such other information as is necessary to demonstrate to the Owner/ Purchaser that all items covered by the drawings are in compliance with the requirements of the Contract.

Drawings may consist of several sheets as required in order to provide for the degree of detail required by the Employer, so that he may clearly understand such drawings.

Not later than 90 (ninety) days after completion of successful trial operation of the HVDC station, the Supplier shall supply copies of the last revision of all drawings produced for this project, stamped as "AS BUILT".

The Supplier shall provide separate sets of drawings for each control cubicle. Typical drawings for similar cubicles shall not be accepted. If there are several cubicles per system, then one common bill of material and one system schematic diagram may be provided. Such system schematic diagram shall show the control scheme for the particular system in its entirety and shall be laid out on the minimum number of drawings sheets consistent with clarity and legibility.

The Owner/Purchaser shall not accept typical drawings for control, protection and three-phase schematics, power circuits and single line diagrams. The Supplier shall supply complete set of such drawings for each system, even when drawings are duplicates.

Inspections plans and documentation

The Supplier shall submit in required number copies for the Owner's/Purchaser's approval an inspection plan (quality plan) describing the inspection system indicating the inspections to be carried out and their sequence in the manufacturing stages.

The inspection plan shall be such that it can be related to the manufacturing program. The plan shall also include a description of the inspection methods employed with reference to the Supplier's written inspection procedures.

Separate inspection plans describing the inspection systems for equipment supplied by each sub-Supplier, in the same form as that of the Supplier, shall be submitted for the approval of the Owner/Purchaser.

In addition to the inspection plans referred to above, the Supplier shall submit complete and satisfactory evidence of possessing a working scheme assuring the control of all critical activities pertinent to the assurance of quality, and objective evidence (by means of quality manuals and appropriate forms, etc.) of this capability to employ and maintain quality control to meet the required quality level of the manufacture and construction of the Works.

Supplier's Quality Control Program in the context of this Clause means the implementation of a quality assurance program by means of which full conformance of material and workmanship to best

quality standards can be achieved effectively and economically by the Supplier's control and surveillance of all essential inspection operations, and periodic verification of the results of the manufacture of equipment and the assembly, erection and installation of equipment at the sites.

Required number of copies of all test reports, including those supplied by Sub-Suppliers, and shall be submitted to the Owner/Purchaser for approval. The Supplier shall include in the report all additional data required by the Owner/Purchaser to permit a clear understanding of the reports.

All test reports shall be certified and shall contain the signature of the Inspector as having witnessed the test, unless such witnessing has been specifically waived by the Owner/ Purchaser. A certified test report shall be issued for each test.

Instruction manuals and operating manuals

The Supplier shall provide Instruction & Maintenance Manuals for each part of the Plant and Equipment included in the Works and Operating Manuals for each Station.

The Instruction Manuals and Operating Manuals shall be arranged in an organized library adequately cross referenced to facilitate issuing clauses of the manuals as required by the work i.e. erection instructions shall be required before operating & maintenance instructions.

All Manuals provided by the Supplier shall be fully detailed and specifically prepared for the Works and equipment provided. General manuals not specifically required for the work shall not be acceptable.

The instruction manuals shall at least contain:

a) A general description of all components
b) Storage instructions
c) Erection instructions
d) Pre-commissioning Instruction :
e) Material and part list.
f) Design clearances and settings
g) Complete sets of drawings as finally issued
h) Operating Instructions:
i) Routine and Preventive Maintenance instructions with material requirement for each site
j) Preventive Maintenance Schedule.
k) Replacement instruction for all equipment

The operation manuals shall at least contain:

a) Operator oriented functional descriptions of the equipment.
b) Operator oriented description of the protection and control systems
c) Description of the equipment auxiliary systems
d) Fault finding and diagnostic tools
e) User software interface tools for modification/augmentation etc.

Notes:

The supplier may please note that all resubmissions must incorporate all comments given in the ear-

lier submission by the Owner/Purchaser or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

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 Supplier to the Owner/Purchaser.

The Supplier shall furnish to the Owner/Purchaser, catalogues of spare parts also.

3.7 Quality assurance requirements

Quality assurance programme

To ensure that the equipment and services under the scope of Contract, whether manufactured or performed at the Supplier's Works or at his Sub-supplier's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Supplier shall adopt a suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be outlined by the Supplier and shall be submitted by the supplier after the award of contract and finally accepted by the owner after discussions prior to commencement of manufacturing.

A quality assurance programme of the supplier shall generally cover the following:

(a) Supplier's organisation structure for the management and implementation of the proposed quality assurance programme;
(b) Design and Documentation control system;
(c) Qualification data of Supplier's key personnel;
(d) The procedure for purchases of materials, parts components and selection of sub-Supplier's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchased 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 and testing equipment.
(i) System for quality audits;
(j) System for indication and appraisal of inspection status
(k) System for authorising release of manufactured product to the Purchaser
(l) System for maintenance of records;
(m) Furnishing of quality plans (QP)/inspection and test plan (ITP) for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

General requirements - Quality assurance

1. All services, materials, components and equipment covered under this specification shall be engineered, designed, procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. It is the Supplier's responsibility to draw up and implement agreed programme for system as a whole as well as for individual equipment.

The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Supplier and shall be submitted to the Employer for approval.

The Supplier shall furnish with his bid a list of approved suppliers for the information of the Employer.

2. Engineering and design quality Plan shall detail out the studies, overall detail design documentation and communicating, defining interfaces and controlling changes. To achieve quality, reliability and schedule objectives that project shall be designed so that it meets performance requirements. Manufacturing Quality Plan shall detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this Specification and standards mentioned therein and quality practices and procedures followed by Supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents etc., during all stages of materials procurement, manufacture, assembly, and final testing/performance testing.

3. Field Quality Plan shall detail out for all the equipment, the quality practices and procedures etc. to be followed by the Supplier's site Quality Control Organisation, during various stages of site activities from receipt of materials/equipment at site onwards.

4. The Supplier shall also furnish copies of the reference documents/plant standards/ acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with respective Quality Plan. These Quality Plans and reference documents/standards etc. shall be subject to Employer's approval without which manufacture shall not proceed. In these approved QPs, the Employer shall identify customer inspection points (CIP), test/checks which shall be carried out in presence of the Employer's Engineer or his authorised representative and beyond which the work shall not proceed without consent of Employer or his authorised representative in writing. All deviations to specification, approved quality plans and applicable standards must be documented and referred to the Employer for approval and disposition.

5. No material shall be dispatched from the manufacturer's works before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspections by Employer's Engineer and / or his authorised representative, and duly authorised for dispatch issuance of Material Inspection Clearance Certificate (MICC). Before making request for issuance of MICC, the Supplier shall ensure that approval of type tests, data sheets, drawing etc. had already been obtained from Employer. All materials used or supplied shall be accompanied by valid materials certificates and tests and inspection reports. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

6. All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME section - IX/BS-4870 or other International equivalent standard acceptable to the Employer.

7. All the (sub)-Vendors proposed by the Supplier for procurement of bought out item list of which shall be drawn up by the Supplier and finalised with the Employer shall be subject to the Employer's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Employer and shall form part of the purchase order between the Supplier and the Vendor.

8. The Employer reserves the right to carry out quality audit and qualify surveillance of the systems and procedures of the Supplier's of their sub-Supplier's (sub-vendor's) quality management and control activities. The Supplier shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

9. As a part of quality assurance of engineering and design, the technical review meetings (TRMs) shall be conducted between the Employer and/or his consultants/representative and the Supplier and/or his subSupplier(s). The duration and cycle of such TRMs shall be as frequent and regular as required to meet the time schedules. The meetings shall be held at either at the Employer's office and/or at the office/manufacturing place of the Supplier/sub-Supplier or at any other place as agreed mutually.

10. The Supplier shall agree upon a schedule of submissions of documents concerning the Quality Assurance Program within two months of the effective date of the Contract. This schedule shall indicate the list of mutually agreed items/equipment for which quality Plans shall be submitted by the Supplier and the last dates for the submissions. It shall be ensured by the Supplier that the submissions are so programmed that all relevant approvals are obtained from the Employer for these documents in a timely manner before the material induction and commencement of the manufacture for any equipment.

11. The documents that shall be submitted by the Supplier to the Employer for review and approval as per the agreed schedule include:

    a) QA Manuals
    b) Quality Plans (Inspection & Test Plans) for all equipment/materials manufactured in the Supplier's works and/or in the sub-Supplier's works
    c) Purchase Specifications for equipment procured from sub- Suppliers.
    d) Supplier's assessment reports of his sub-Suppliers
    e) Field Quality Plans for all activities at site
    f) Reference documents referred to in Quality Plan.
    g) Erection, commissioning, operation and maintenance manuals

12. QA Document Package

The Supplier shall submit the following Quality Assurance Documents to the Employer. These documents shall be as per the approved Quality Plans for the concerned equipment. The documents shall include, but not limited to, the following:

    a) Routine test reports & Acceptance test reports
    b) Type test reports
    c) Quality records etc. corresponding to items identified Quality Plan
    d) Inspection reports for Customer inspection points
    e) Reports on repair/modification carried out to make the item/equipment acceptable.
    f) Non-destructive examination result reports including radiography interpretation reports, wherever applicable.

The above documents are required to be submitted in required number of copies within three weeks after dispatch of equipment.

Inspection and testing

1. In order to verify that all the manufacturing of equipment by the Supplier as well as materials & equipment being procured and provided by the Supplier are in complete conformance with the requirement of theContract, the Employer and/or his duly authorized representative shall have access to the Supplier's premises or works at all reasonable times to inspect and examine the material, equipment and workman ship during its manufacture or installation. In addition to carrying out inspection the Employer and/or his authorized representative/Consultant all carry out quality audit on the Supplier's Quality Assurance System and conduct quality surveillance to check conformance to quality procedure/practice in general. The Supplier shall provide necessary facilities to carry out all the above activities at their works and the works of the sub- Suppliers.

2. The Supplier shall provide a detailed inspection schedule for those inspection stages identified as CIP and shall furnish updated schedules once every two months.

3. The Supplier shall give the Employer/Inspector six(6) weeks written notice, by telex or by letter, of the tentative date any material/equipment shall be ready for witness points, corresponding to Customer inspection points (CIP), when the Employer/Inspector is based in India. Final confirmation shall be given at least 15 days in advance. The Employer/Inspector, unless witnessing of the tests is waived, shall attend such tests, failing which the Supplier may proceed with the test which shall be deemed to have been made in the Inspector's presence. The Supplier shall forthwith forward to the Employer copies of duly certified test reports. Test reports of all tests corresponding to CIP performed in the supply shall be reviewed and approved, subject to satisfactory conduction and successful passing of the test, by the Employer or his authorised representative (even if the witnessing of the test was waived).

4. The Employer or his authorized representative shall, within fifteen (15) days from receipt of such reports, give notice in writing to the Supplier of any objection to any aspect of the test reports or any or all equipment and workmanship which in his opinion is not in conformance with the Contract. The Employer or his authorized representative shall advise his reasons for objections on completion and review of the activity. The Supplier shall give due consideration to such objection(s) and shall either make the modifications that may be necessary to overcome the said objection(s) or shall confirm in writing giving reasons therein that no modifications are necessary to comply with the Contract. However, the Supplier may proceed with the works/dispatch even before the receipt of written objection(s), if any, at his own cost & risk.

5. Whenever the Employer's inspection engineer undertakes the inspection, at a particular stage identified as Customer inspection point (CIP) in the Quality Plan, the acceptance of test reports/test results and the MICC where applicable shall be given immediately after the test if the results, including those for previous points identified as per clause 9.6 are found to be in conformity with the Contract. In case of any deviations, the Employer/Inspector at his discretion may refer the matter to the Employer's main office, together with the manufacturer's comments, who in turn shall communicate his final decision regarding the acceptance or otherwise to the Supplier within fifteen (15) days of the receipt of such test reports/results. In case the presence of the Employer/Inspector is waived, the acceptance of test results and issuance by the Employer of Material Inspection Clearance certificate wherever applicable, shall be given within fifteen (15) days after receipt of test reports/results for the CIP as well as for previous CIP's identified in the approved Quality Plan, provided such test reports/test results are found to be in order. The Em-

ployer/Inspector shall at his discretion and based on the outcome of any inspection and the requirements of the contract, have the right to 'accept', 'accept as noted' or 'reject' any equipment/material. The reasons/comments in case of each ruling shall be communicated to the Supplier in writing.

6. In all cases where the contract provides for tests, whether at the premises of works of the Supplier or of any sub-Supplier, the Supplier, except where otherwise specified, shall provide free of charge such items as labour, materials, electricity, fuel, water, apparatus and instruments as required to fulfil the requirements of the approved Quality Plan.

7. The inspection by Employer/Inspector or waver of the presence of the Employer/Inspector, issue of CIP clearance certificate and issue of Material Inspection clearance certificate (MICC) thereon shall in no way limit the liabilities and responsibilities of the Supplier in respect of the agreed quality plans forming part of the contract. The Employer shall not be found to accept the material/equipment if on further testing it is found to be not in compliance with the requirements of the contract. The Supplier shall include in all orders to his sub-Suppliers, the requirements for any equipment, being supplied by the sub- Supplier for incorporation in his equipment to be subjected to inspection and testing by the Employer or is authorised representative. Copies of such orders or purchase specifications, blanked for prices, shall be forwarded to the Employer.

8. The costs of all tests specified in the Contract together with the same for all tests facilities, test samples and such like shall be to the Supplier's account.

9. The Employer/Inspector shall have complete authority to reject, on behalf of the Employer, any material, equipment or parts thereof considered unsatisfactory and not in accordance with the Contract. Accept, accept as noted or reject materials, equipment or any components thereof shall not relieve the Supplier of any of his obligations under the Supplier, nor impose any liability whatsoever on the Employer.

10. The Employer shall have the right to have Inspectors on the Sites, on a regular basis or from time to time as required at his sole discretion to monitor the quality and the progress of the work. Generally the site inspection shall be as per the approved Field Quality Plans (FQPs) and the Installation & Operation Manual(s). All quality related documents and test results shall be a part of plant documentation.

3.8 Materials and workmanship

Where the specification does not contain references to workmanship, it is understood that the equipment shall be new, of the best quality and in accordance with the purpose for which they are intended.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard, the owner shall decide upon the question of similarity. When required by the specification or when required by the Purchaser & owner the Supplier 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 Supplier.

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 shall be used throughout the design.

All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned to fulfil 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 owner.

Whenever possible, all similar parts of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be made interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. All the equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Supplier shall apply oil and grease of the proper specification 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 in readiness for applying the lubricant required for operation. The Supplier shall apply all operational lubricants to the equipment installed by him. All insulating oil, lubricating material, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Supplier has any special requirement for the specific application for 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 or other consumables is available. In any case he shall identify equivalent Indian makes and inform the Purchaser & owner of the name of at least two Indian suppliers before handing over of the Works to the Purchaser. All consumables required upto operational acceptance shall be the part of supply scope of the Supplier.

The supplier shall perform all tests and inspection necessary to ensure that the material and workmanship conform to the approved design drawings and that such tests are adequate to demonstrate that the equipment shall comply with the requirements of the Specification & relevant standards.The supplier shall test the component parts at his plant or his Sub- supplier's plant, prior to packaging and shipping, to determine that the performance requirements have been met. All testing shall be in accordance with the Standards related to the piece of work.

3.9 Colour schemes

The Supplier shall propose a colour scheme for the equipment for the approval of the Employer. The decision of the Employer shall be final. However, the finishing colour shall be RAL 7035 for indoor panels and RAL 7032 for outdoor panels. The scheme shall include:

- Finishing colour of Indoor equipment
- Finishing colour of Outdoor equipment
- Finishing colour of various auxiliary system equipment including piping
- Finishing colour of various building items.

- Finishing colour of all cubicles.

All steel structures, plates etc shall be painted with non-corrosive paint on a suitable primer. The galvanised structures in the switchyard shall not be painted. However galvanised structures in other areas may require painting for aesthetic reasons.

3.10 Clamps & connectors

i) All power clamps and connectors shall conform to IS: 5561, and/or IEC standard and shall be made of materials listed below:

a)	For connecting ACSR conductors	Aluminium alloy casting, conforming to designation A6 of IS: 617 and shall be tested for all tests as per IS:617
b)	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminium alloy casting, conforming to designation A6 of IS 617 with 2 mm thick Bimetallic liner and shall be tested as per IS: 617.
c)	For connecting G.I. Shield wire	Galvanised mild steel
d).1	Bolts, nuts & Plain washers.	Electro galvanized for sizes below M12, for others hot dip galvanised
d).2	Spring washers for items 'a' to 'c'	Electro-galvanised mild steel suitable for at least service condition-3 as per IS: 1573

ii) 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. The requirements 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. In case the connector is not available then equivalent connector may be used. 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.

iii) Where copper to aluminium connections are required, bi-metallic clamps shall be used, which have been properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current t shall be furnished to the Employer.

iv) Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified are also included in the scope of Work.

v) 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 2mm thickness shall be cast integral with aluminium body for Bi-metallic clamps. When copper alloy is not cast integral with aluminium body, a bimetallic washer or strip shall be used to meet the functional requirement.

vi) All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

vii) 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 IPS Aluminium tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.

viii) 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.

ix) All current carrying parts shall be designed and manufactured to have minimum contact resistance.

x) TESTS

The following is the list of type tests.
a) Temperature rise test (maximum temperature rise allowed is 35deg C over 50 deg C ambient)
b) Short time current test
c) Dry corona and RIV test as per annexure-A
d) Resistance test and tensile test

3.11 Name Plates and Markings

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

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

All relays and other devices shall be clearly marked with manufacturer's name, manufacturer's type, serial number and electrical rating data.

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

All the panels shall be provided with nameplate mounted inside the panel. Stainless steel nameplates shall be installed on all apparatus and on all major equipment components. For indoor cubicles, nameplates made of aluminium shall also be acceptable. Name plates shall be white with black engraved lettering and shall carry all the applicable information specified in the applicable items of the Standards, together with any other relevant information which may be required. For groups of smaller items for which this is not possible e.g. switch bays etc. a common nameplate with the title and special instructions on it shall be provided. No scratching, corrections or changes shall be allowed on nameplates. Main equipments like converter transformer, CBs, Reac-

tor, Filter gates etc shall have nameplates in Hindi also.

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

All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate tracing of the wiring. The nameplates shall be mounted directly by the side of the respective equipment and shall not be hidden by the equipment wiring.

The nameplate inscription and size of nameplates and letters shall be submitted to the Employer for approval.

The nameplates of the apparatus shall include, at least, the information listed below, together with any other relevant information specified in the applicable standards:

a) A concise descriptive title of the equipment

b) Rating and circuit diagram reference numbers

c) Manufacturer's name, trade-mark, model type, serial number d) Instruction book number
e) Year of manufacture

f) Total weight (for capacitor racks indicate weight, for capacitors indicate quantity of liquid)

g) Special instructions, if any, about storage, transportation, handling etc.

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

Danger plates and plates for phase colours shall be provided as per requirement. The Supplier shall devise a system to designate equipment and sub-systems. The nameplates/ labels displaying these designations shall be installed at appropriate locations. Wherever motion/ flow of fluids are involved, plates/ marks showing direction of motion/ flow shall also be provided.

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.

All such nameplates, instruction plates, rating plates of transformers, reactors, CB, CT, CVT, SA, Isolators, C & R panels and PLCC equipments 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.

3.12 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.

3.12.1 Space Heaters

The heaters shall be suitable for continuous operation at 240 V ac supply voltage & shall be connected to the supply through a fuse.

One or more heaters shall be provided, with thermostats or hygrostat, to prevent condensation in any compartment. The heaters shall be suitable to maintain the compartment temperature at approximately10 deg. C, above the outside air temperature to prevent condensation.

Control cubicles installed in air-conditioned area need not be provided with space heaters. These cubicles shall, however, have space heaters in case of storage of cubicles for long duration.

3.12.2 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.

3.12.3 Ventilation Opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass or galvanized steel 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.

3.12.4 Tropicalisation

The service building and bay kiosk shall be air-conditioned whereas the valve halls and indoor DC yard at Agra shall have ventilation system with positive pressure. All equipments shall, however, be suitable for installation in a tropical monsoon area having hot, humid climate and dry & dusty seasons with ambient conditions as specified. All control wiring, equipment and accessories shall be protected against fungus growth, condensation, vermin and other harmful effects due to a tropical environment.

3.13 Painting and finishing of metal surfaces

All sheet steel work shall be phosphated in accordance with the IS:6005 "Code of practice for phos-

phating iron and steel".

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

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

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

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

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

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

In case the Supplier proposes to follow his own standard surface finish and protection procedures any other established painting procedures, like electrostatic painting etc., the procedure shall be submitted along with the Bids for Purchaser's review & approval. The Supplier shall use procedures for painting approved by the Employer during detailed Engineering.

3.14 Hot Dip Galvanising

The minimum weight of the zinc coating shall be 615 gm/ sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. For items less than 6 mm, requirements of coating thickness shall be as per relevant ASTM. For surfaces, which shall be embedded in concrete, the zinc coating shall be 900-gm/sq.m .

The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects noticed on visual inspection shall render the material liable to rejection.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment except the nuts may be rethreaded after galvanizing. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanization.

The galvanized steel shall be subjected to six one-minute dips in copper sulphate solution as per IS-2633.

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 be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

3.15 Control cabinets, junction boxes, terminal boxes & marshalling boxes for equipment

All types of boxes, cabinets etc. shall generally conform to & be tested in accordance with IS-5039/IS-8623, IEC-60439, as applicable, and the clauses given below:

1. Enclosure for control cabinets, junction boxes, Marshalling boxes & terminal boxes shall be made of stainless steel or aluminium and shall be dust, water and vermin proof. 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.

2. The enclosures of the control cabinets, junction boxes, terminal boxes & marshalling boxes located outdoor shall provide a degree of protection of not less than IP 55 as per IS-13947:Part I One control cabinet, junction box, terminal box & marshalling box of each type shall be tested for the same.

3. Cabinets/boxes shall be freestanding floor-mounting type, wall mounting type, or pedestal mounting type as required. Equipments such as telephone exchange, Public address systems etc shall be kept inside cubicles.

4. Cabinets/ 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.

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. Ventilating louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

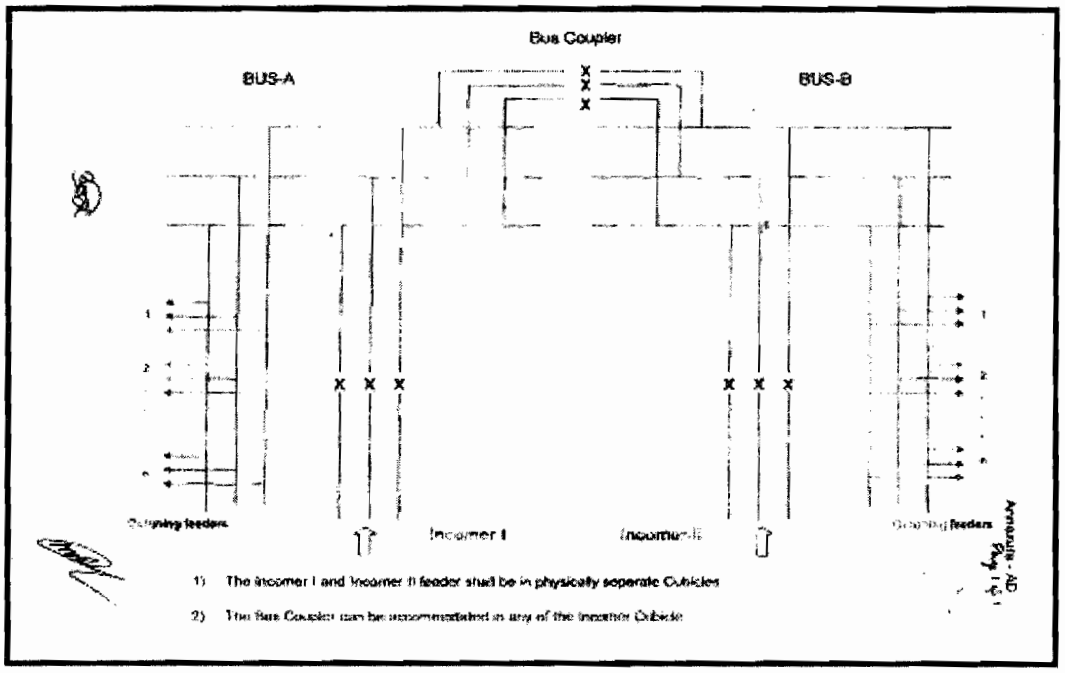
6. All boxes/cabinets shall be designed for the entry of cables from the bottom by means of weatherproof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. A suitable horizontal cable gland plate positioned 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 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 and shall be nickel-plated.

Boxes / cabinets to be located inside a building in a non air- conditioned area may be designed for the entry of cables from the bottom or from the top.

The (415 V) secondary distribution system shall be made up of 415 V power centres serving the different classes of loads either directly or thorough motor control centres. Two separate 415 V power centres, one for each pole shall be provided. The two sections of power control centres (PCC) feeding the duplicated loads, like pumps, fans, heat exchangers, etc. as well as the duplicated supply circuits shall be physically independent, permanently energized and fed by different sections of the 415 V power centres. A tie circuit breaker, shall be provided between the two sections of above PCC feeding the duplicated loads, in order that when one section of PCC is out for maintenance or fault, the other section can supply all the loads.

The motor control centres (MCC) shall be provided in accordance with the relevant Standards. The MCC shall be located near the supplied loads. The incomers of the MCC shall be individually interlocked to prevent paralleling of two different power centre buses. The 240 V loads shall be supplied by 240 V panels located in the MCC or outside the MCC where it is required.

415 V MCCs for valve cooling, pump house, valve hall ventilation system, air-conditioning system etc. shall be arranged as per figure given below:



25% spare feeders, but not less than one of each type and rating shall be provided on 415V switchgears, power centres and motor, control centres as well as on all dc distribution boards

The AC & DC Distribution Boards shall have a fixed type, floor-mounted, free-standing, metal enclosed, with compartmentalised construction. They shall have separate Busbar chamber and cable alleys. All equipment for each feeder (i.e. main switch, HRC fuses, neutral link and cable terminals) shall be housed in a fully enclosed compartment with a separate hinged door,

such that fuse replacement, cable termination/replacement etc. are possible with complete safety, even if the Busbar and adjacent feeders are live. The connections from Busbar to the main switch shall be fully insulated/shrouded, and securely bolted. The partition between the feeder compartment and cable alley shall be non- metallic and shall be of such construction as to allow cable cores with lugs to be easily inserted in the feeder compartment for termination. Cable alley shall have no exposed live parts, and shall have no communication with Busbar chamber. The main switch shall be operated from outside, and shall be interlocked with the compartment door such that the latter can be opened only when the switch is OFF. However, it shall be possible to defeat this interlock and open and close the door with the switch ON. Busbar chamber shall be completely enclosed with metallic partitions. Bolted covers shall be provided for access to horizontal and vertical Busbar and all joints, for repair and maintenance, which shall be feasible without disturbing the feeder compartment. Cable alley door shall preferably be hinged. The main switch shall have the facility of being pad- locked in both ON and OFF positions. The switch handle shall clearly indicate the position of main switch. The Supplier shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley, for at least 50% of the total number of feeders. The distribution boards shall have a degree of protection of at least IP52 as per IS-13947:Part I.

All 415V switchgear (circuit breaker boards) shall be of single front type, with fully draw out circuit breakers, which can be drawn out without having to unscrew any connections. The circuit breakers shall be mounted on rollers and guides for smooth movement between SERVICE, TEST and ISOLATED positions and for withdrawal from the Switchboard. Testing of the breaker shall be possible in the TEST position. Unless kept in OFF position it shall not be possible to withdraw the modules from service position or rack them into service position.

All outgoing feeders in distribution boards shall be through MCBs/MCCBs.

Circuit breakers shall be three pole air break horizontal draw out type and shall have inherent fault making and breaking capacities as specified. The circuit breakers which meet specified parameter only after provision of releases or any other devices shall not be acceptable.

All circuit breakers shall be provided at least with 4 NO and 4 NC potentially free auxiliary contacts. These contacts shall be in addition to those required for internal mechanism of the breaker. Separate limit switches each having required number of contacts shall be provided in both 'SERVICE' & 'TEST' position of the breaker.

Control cabinets, junction boxes, Marshalling boxes and terminal boxes shall be made of sheet steel or aluminium enclosure.Sheet steel used shall be at least 2.0-mm thick cold rolled or 2.5 mm hot rolled. In case of aluminium enclosed box the thickness of aluminium shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness.

7. Earthing

The provision for earthing shall be generally as per requirements given in Clause 3.16.2

8. Tests

a) The Marshalling Kiosks shall be subject to routine tests as per IS: 5039

b) The following routine tests shall also be conducted:

i) Check for wiring

ii) Visual and dimension check

Marshalling kiosk shall be provided with danger plate and a diagram showing the numbering/ connection/ ferruling by pasting the same on the inside of the door.

Marshalling kiosk shall also be provided with incoming MCB and one 15 Amp interlocked switched socket in addition to the MCB required.

3.16 Indoor control cubicles

The control panel, cubicles and desks shall be in accordance with the relevant IEC standards and shall be installed in air-conditioned space. Indoor electronic cubicles shall not generally require fans for cooling in order to operate successfully and correctly at the maximum ambient temperature. However, if it is absolutely necessary to install fans etc. in cubicles for cooling then these shall be driven by the same dc supply as used for control, and necessary redundancy, failure alarm etc. shall be incorporated. Louvers in the doors and side panels shall be permitted, if required.

The control and relay panels shall be suitable for numerical relays of modular type mounted in standard 19 inch racks located on the vertical front panel with rear doors for access or located on the front doors for front access type panels. Panels Cubicles shall be completely metal enclosed and shall be dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP 32 in accordance with IS-13947:Part I for cubicles located in air-conditioned areas. IP 31 may also be acceptable for these areas if the layout is arranged such that there is no possibility at all of any liquid entering the area. However, for ventilation reasons the cubicles may be provided with a ventilation hood at the top with a protection class of IP21.

Panels shall be free standing, floor mounting type and shall comprise structural frames enclosed completely with specially selected smooth finished, cold rolled sheet steel of thickness not less than 2.5 mm for weight bearing members of the cubicles such as base frame, front sheet and door frames, and 1.5 mm for sides, door top and bottom portions. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transportation and installation. The cubicles shall be provided with lifting lugs.

All doors, removable covers and plates shall be gasketed all around with neoprene gaskets. Ventilation louvers, if provided, shall have screens and filters. The screens shall be made of either brass or GI wire mesh with a graduation of 1 mm or less.

Design, material selection and workmanship shall be such as to result in a neat appearance, inside and outside with no welds rivets or bolt heads apparent from outside, with all exterior surfaces true and smooth. All cubicles located in any room shall be matched in appearance.

The Supplier along with anchor bolts and necessary hardware for mounting the cubicles shall furnish metal sills in the form of metal channels properly drilled. Panels shall have an additional rolled channel plinth at the bottom with a smooth bearing surface. The panels shall be fixed on channels with intervening layers of anti- vibration strips made of shock absorbing material, which shall be

supplied by the Supplier.

Supplier's standard practice for control panels shall be acceptable to the Employer/Purchaser subject to approval during detailed engineering and meeting all functional requirements of the specification.

3.16.1 Mounting

All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for external connections. The equipment on front of panel shall be mounted flush. No equipment shall be mounted on the doors.

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

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

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

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

No equipment shall be mounted on the doors.

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

3.16.2 Earthing

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

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

of supply of Supplier.

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

4) Looping of earth connections, which would result in loss of earth connection to other devices when the loop is broken, shall not be permitted. Earthing may be done in such a manner that no circulating current shall flow in the panel.

5) VT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system for other groups.

6) An electrostatic discharge point shall be provided in each panel connected to earth bus via 1 Mega Ohm resistor.

3.16.3 Instruments, meters and recorders

Only digital displays and systems shall be provided. The requirements in this section are applicable to auxiliary systems only. All instruments, meters and recorders shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. They shall be calibrated to read directly the primary quantities. They shall be accurately adjusted and calibrated at the factory and shall have means of calibration, checking and adjustment at site.

3.16.4 Miscellaneous

1) The Supplier shall submit all type and routine test certificates to the Employer & Purchaser for approval before dispatching the equipment. Control and relay panels shall also be subjected to the following tests:
   i) Mechanical operation test
   ii) Verification of degree of protection as per IS-13947:Part I
   iii) High voltage test
   iv) Electrical control, Interlock and sequential operation test
   v) Verification of wiring as per approved schematic.

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

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

4) MCB's: Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of DC and AC supplies for various control, signalling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with miniature circuit breakers (MCB).

5) Space Heater: Panels wherever required shall be provided with a space heater rated for 240V single phase, 50 Hz Ac supply for the internal heating of the panel to prevent condensation of moisture. The fittings shall be complete with thermostat and switch fuse /MCB unit.

3.16.5 Terminal blocks and wiring

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

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

Spare terminals for Employer's use for upgrading to 6000 MW shall be provided wherever required. In addition, at least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

The terminal blocks shall be suitable for connecting the conductors of external cable on each side.

Terminal blocks shall be of (at least) 650V grade and have 10 amps continuous rating. These shall be moulded, complete with insulated barriers, stud type terminals, complete with washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud terminals with locking type. The terminal blocks shall be of reputed make subject to Employer's acceptance.

Terminal block design shall include a white fibre marking strip with clear plastic, /clip-on terminal covers. Markings on the terminal strips shall correspond to wire numbers on the wiring diagrams.

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.

The conducting part in contact with the cable shall preferably be tinned or silver-plated however; nickel-plated copper shall also be acceptable. Insulating barriers shall be provided between the terminal blocks.

Manufacturer's standard practice for internal wiring of cubicles shall be acceptable to the Employer. However all external cabling requirements shall be strictly as per TS.

The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connections (where applicable) as well as between phases and common terminal boxes or control cabinets.

3.17 Degree of protection

The enclosures of the control cabinets, Junction boxes and Marshalling boxes, panels etc. to be installed as detailed here under:

The minimum requirements for panels are as follows:

Installed out door: IP- 55
Installed indoors in air-conditioned area: IP-32
Installed in covered area: IP-52
Installed indoors in non air-conditioned area where possibility of entry of water is limited: IP-41.
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

3.18 Welding and welders' qualifications

All welding shall be in accordance with the corresponding standards of the American Welding Society or the American Society of Mechanical Engineers. Welding shall comply with powergrid approved quality plan.

Other standards to determine the quality of welding processes and qualifications of welders may be considered, provided that sufficient information is first submitted for the approval of the Employer.

Prior to the start of fabrication, the Supplier shall submit to the Employer for approval, a description of each of the welding procedures which he proposes to adopt, together with certified copies of reports of the results from tests made in accordance with these procedures.

The Supplier shall be responsible for the quality of the work performed by his welding organization. All welding operators shall be assigned to the work, including for repair of castings, shall pass the required tests for qualification of welding procedures. The Employer reserves the right to witness the qualification tests for welding procedures and operators and the mechanical tests of the samples. If the Inspector so requires, the Supplier shall furnish to the Inspector certified copies of reports of the mechanical test results of the samples.

The Supplier shall bear all his own expenses in connection with the qualification tests. If the work of any operator at any time appears questionable, such operator shall be required to pass appropriate re-qualification tests as specified by the Inspector and at the expense of the Supplier.

Strict measures for quality control shall be exercised throughout the Equipment/Works. The Engineer may call for an adequate NDT test of the work of any operator, who, in his opinion, is not maintaining the required standard of workmanship. Should this NDT test prove defective, all work done by that operator, since his last test shall be tested at the Supplier's expense. If three or more of these tests prove defective, the operator shall be removed from the project.

A procedure for the repair of defects shall be submitted to the Employer for his approval prior to any

repairs being made.

3.19 Motors

All motors shall conform to IEC-60034-5 / IS Standard and with principal dimensions in accordance with IEC 60072-1 (1991), IEC 60072-2 (1990) and IEC 60072-3 (1994).

Motors rated 0.5 kW and above, and reversing motors, shall be rated 415 V, three phase, grounded neutral;

Motors rated below 0.5 kW shall be rated 240 V one phase;

All motors shall be designed to operate at full load dynamic conditions with a voltage range of variation of +10%, -20% and a frequency range variation of +5%,-10%. Motors shall also be designed to operate at 125% of the rated speed without mechanical damage, and to start with 80% of their rated voltage;

All motors shall be designed and rated for continuous operation at maximum ambient temperature of 50oC. The class of insulation shall be at least one class higher than used for defining the temperature rise of the motor;

Vertical motors rated 60 kW and above shall be provided with oil-lubricated
self-cooled pivoted shoe-type thrust bearing. Vertical motors below 60 kW shall be provided with re-greasable anti-friction ball or roller bearings;

All anti-friction bearings shall be guaranteed to operate successfully for a minimum of 131,000 hours;

All bearings shall be quiet operating and statically and dynamically balanced;

All belts to be used shall be "V" type and designed for the maximum power to be transmitted and for the maximum speed. The selection of the "V" belt drive for any application shall also be based on the nature of the load and the type of the driving unit. Belts installed outdoors shall be suitably protected.

3.20 Conduits, pipes and accessories

The Supplier shall supply and install all rigid conduits, mild steel pipes, flexible conduits, hume pipes etc. including all necessary sundry materials, such as tees, elbows, check-nuts, bushings, reducers, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes etc. The size of the conduit/pipe shall be selected to limit the fill to a maximum of 40%. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed in an approved manner to prevent damage to threaded portions and en- trance of moisture and foreign materials.

PVC conduits shall be of high impact, heavy gauge (at least class 2) conduit conforming to BS-4607.

The outer surface of the steel conduits shall be coated with hot-dip zinc and chromate conversion coatings. The inner surface shall have silicone epoxy ester coating for easy cable pulling. Mild steel

pipes shall be hot-dip galvanized. All rigid conduits/pipes shall be of a reputed make.

The hume pipes and accessories shall be of reinforced concrete conforming to class NP2 of IS-458. All tests on hume pipes shall be conducted as per IS-458.

Flexible conduits shall be of heat-resistant lead coated steel, water-leak, fire and rust proof.

3.21 Packaging & protection

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 Supplier 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 Supplier shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, warping and other such charges claimed by the transporters, railways etc. shall be to the account of the Supplier. Purchaser takes no responsibility of the availability of the wagons.
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 piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

3.22 Auxiliary supply

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, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform to the parameters as indicated in the following :

Table 24 - 3 Table for Auxiliary Supply

Normal Voltage	*Variation in Voltage*	*Frequency in Hz*	*Phases*	*Neutral Connection*
415V	± 10%	50 ± 5%	3 or 4 Wire	Solidly Earthed
240 V	± 10%	50 ± 5%	2 Wire	Solidly Earthed
220V	190 - 242	DC	-	Isolated 2 wire system DC unearthed system
48 V	41 - 52.8	DC	-	Isolated 2 wire system positive pole directly earthed

Combined variation of voltage and frequency shall be limited to ± 10%.

3.23 Lamps and sockets

Lamps

All incandescent lamps shall use a socket base as per IS-1258, except in the case of signal lamps.

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. Degree of protection for outdoor switch sockets shall be IP55.

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.

Switches and Fuses

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. 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.

3.24 Availability spares

The Supplier shall supply the spare parts required to meet the specified guaranteed availability, and shall include such spare parts in the scope of supply. The detailed lists of spare parts to meet the guaranteed reliability & availability requirements shall be part of the contract documents. However if it is found during detailed engineering and/or Reliability & Availability prediction calculation that additional spares are required to meet target values, the same shall be made available by the Supplier without any additional cost to the Employer.

3.25 Commissioning spares

The Supplier shall supply additional spares which he expects to consume during installation, testing and commissioning of the systems. The quantity of these spares shall be decided based on his previous experience, such that site work shall not be hampered due to non-availability of these spares.

3.26 Tools & tackles

The Supplier shall also supply at each site one set of all special tools & tackles, testing equipment, handling equipment, etc. which are required by the Employer's maintenance staff to maintain the stations successfully.

3.27 Seismic force consideration

All structures shall be designed for seismic forces in accordance with IS-1893.

The seismic design of electrical equipment shall be performed using estimated actual earth/ ground motion,defined by a response spectrum, rather than the equivalent loads specified in typical Building Codes.

For brittle materials like glass, porcelain and glass fibre reinforced plastic the maximum calculated load should not exceed 2/3 of the guaranteed minimum rupture (breaking) strength (safety factor 1.5) as defined by the manufacturer/supplier of the material used. The minimum rupture value is defined as (X - 2*sigma), where X is the mean value and 'sigma' is the standard deviation. For load combinations in porcelain insulators and similar the following expressions shall be fulfilled:

{Ft / (Ft)b } + {Mb / (Mb)b } < 2/3 and
{ Fc / (Fc)b } + { Mb / (Mb)b }< 2/3

Where:

Ft, Fc, Mb : calculated maximum tensile force; compressive force and bending respectively

(F), (F), (M)b : corresponding guaranteed strength values

(For normal operating loads, a higher safety factor more than 1.5 shall be used, normally 2.0-2.5 depending on type of load as per recommendations of manufacturer).

Factor regarding importance of structures (I), as defined in IS-1893, shall not be taken less than 1.5.

3.28 Safety requirements

The requirements regarding provision of additional staircases and approachability as defined in the Fire Protection Manual, issued by the Regional Committees of the Tariff Advisory Committee shall be completely fulfilled. All other safety requirements shall be met as per the factories Act, TAC etc.

ANNEXURE-A
Corona and Radio Interference Voltage (RIV) Test

1. General

Unless otherwise stipulated, all equipment (except Auto Transformer & Shunt Reactor) 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). The test procedure shall be reviewed for different equipment during submission of MQP/ITP.

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 400 kV, 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 level meter.

4. 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 be 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 of 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.