Enquiry

Bharat Heavy Electricals Limited

Transmission Business Group
Materials Management

Enquiry No	Enquiry Dt	Rev No	Rev Dt	PI No	Due Dt	Delivery Requirement
275G007	22-Jun-15	0			21-Jul-15	

Document Enclosed

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

Project	Equipment	Phy Unit	Qty	Unit Exworks	%ED	%CST	Unit F&I	Plan Dt	Comments
NPGCPL NABHINAGAR STPP	OPGW(12 FIBRES) AND ACCESSORIES	LOT	1	✓	✓	✓	✓	15-Jul-15	AS PER TECH SPEC DOC NO TB-350-510-032
NPGCPL NABHINAGAR STPP									
NPGCPL NABHINAGAR STPP	12 Fibre OPGW cable	Km	11	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	19	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	28	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	34	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	62	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – Armor Rods for OPGW	Nos.	19	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	7	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2	✓	✓	✓	✓		

NPGCPL NABHINAGAR STPP	Services – Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	33	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	Services – Termination & splicing of OPGW cable and approach cable	Lot	1	✓	✓	✓	✓		
NPGCPL NABHINAGAR STPP	Services – Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Lot	1	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW(12 FIBRES) AND ACCESSORIES	LOT	1	✓	✓	✓	✓	01-Feb-16	AS PER TECH SPEC DOC NO TB-350-510-032
NTPC NORTH KARANPURA									
NTPC NORTH KARANPURA	12 Fibre OPGW cable	Km	12.6	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	27	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	38	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	47	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	88	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – Armor Rods for OPGW	Nos.	27	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	8	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1	✓	✓	✓	✓		
NTPC NORTH KARANPURA	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2	✓	✓	✓	✓		
NTPC NORTH KARANPURA	Services – Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	46	✓	✓	✓	✓		
NTPC NORTH KARANPURA	Services – Termination & splicing of OPGW cable and approach cable	Lot	1	✓	✓	✓	✓		
NTPC NORTH KARANPURA	Services – Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Lot	1	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW(12 FIBRES) AND ACCESSORIES	LOT	1	✓	✓	✓	✓	31-Aug-15	AS PER TECH SPEC DOC NO TB-350-510-032
RRVUNL SURATGARH	12 Fibre OPGW cable	Km	2.1	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	2	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	12	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	9	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	12	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – Armor Rods for OPGW	Nos.	2	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	4	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1	✓	✓	✓	✓		
RRVUNL SURATGARH	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories	Set	1	✓	✓	✓	✓		

	etc. for approach cable								
RRVUNL SURATGARH	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2	✓	✓	✓	✓		
RRVUNL SURATGARH	Services – Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	8	✓	✓	✓	✓		
RRVUNL SURATGARH	Services – Termination & splicing of OPGW cable and approach cable	Lot	1	✓	✓	✓	✓		
RRVUNL SURATGARH	Services – Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Lot	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@bhel.in or 0120-6748581 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
S C Shivhare
Sr.Manager
BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP
TOWER-A,5th Floor,
Advant Navis IT Business Park,
Plot No-7,Sector-142,Expressway Noida
Noida-201305
Distt. Gautam BudhNagar,U.P

Ph: 0120-6748471
Fax: 0120-6748581

Signature and Seal of Tenderer

Enquiry No : 275G007 **Enquiry Dt :** 22-Jun-15

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

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

Sr. No	**ENQUIRY NO. 275G007 DATED 22/06/2015 DUE ON 21/07/2015**
1.	1. Sealed bids are invited for the items mentioned in the enquiry conforming to specifications. Bids should be typed and free from over writing and erasures, corrections or additions must be clearly written both in words and figures and attested and otherwise offer may be liable for rejection. 2. Bidder to ensure that quotation is received / dropped in the tender box on or before **14.00** Hrs. as per Indian standard time (IST) of the due date of opening in **Material Management Division,** **Transmission Business Group,** **Tower-A, 5th Floor, Advant Navis IT Business Park** **Plot-7,Sector-142,** **Expressway Noida, Noida-201305, UP, India** 3. The tenders will be opened on due date at **14.30** Hrs. as per IST in the presence of participating vendors, who may like to be present. Tenders received late are liable for rejection. Vendors should ensure that an offer is delivered in time. 4. Bids are to be submitted in Two parts: **Part-I: Qualification Criteria/Technical / Commercial Bid (in two copies)** **Part-II: Price Bid** **Part-I Envelopes super scribed with Technical / Commercial Bid to contain information regarding, among others:** 1. Specification 2. Deviations (if any) in deviation sheet of BHEL's Format. 3. All commercial terms, Un-priced copy of Price Bid with units for measurement. 4. Delivery terms & period required for supply from order, Filled in activity Schedule format 5. Evidence for Qualification criteria. **Part-II** Envelopes super scribed with Price Bid should contain priced copy of Price Bid. The price should be mentioned both in figures and words. Price bid containing any additional information is liable for rejection. In case of any difference between figures and words, the quoted rate in words will prevail over figure. If there is a calculation mistake in multiplication of unit rate with quantity, then the unit rate quoted will be considered for calculation. Both Part I and Part II bids are to be kept in separate envelopes and both envelopes to be kept in another common envelope. Each envelope should be sealed and super scribed with enquiry no., item / package name, project name and due date of opening. **Note: 1 Representative deputed to witness tender opening must produce an authority letter from the signatory of offer at the time of tender opening.** **Note: 2 Authorized signatory should authenticate tender documents.** **Note: 3 The bid of bidder will be accepted subject to vendor approval by Customer.**

Sr. No	**ENQUIRY NO. 275G007 DATED 22/06/2015 DUE ON 21/07/2015**
	5. For any Technical clarification, please contact Mr. Vivek Kapil, Sr. Manager-TBEM BHEL, Transmission Business Group, Tower-A, 5th Floor, Advant Navis IT Business Park Plot-7,Sector-142, Expressway Noida, Noida-201305, UP, India Phone : +91 (0) 0120- 6748539, Fax: +91 (0) 0120 – 6748580. e-mail :vivekk@bhel.in For any commercial clarification please contact person issuing enquiry. Mr. S. C. Shivhare, Sr. Manager-TBMM or, Smt. Archana Kumari, Sr. Engr.-TBMM BHEL, Transmission Business Group, Tower-A, 5th Floor, Advant Navis IT Business Park Plot-7,Sector-142, Expressway Noida, Noida-201305, UP, India Phone : +91 (0) 0120- 6748471/8467, Fax: +91 (0) 0120 – 6748581. e-mail :scshivhare@bhel.in / archanak@bhel.in 6. Unsolicited Supplementary / Revised price bid submitted during validity period of offer, unless asked by BHEL, shall not be considered. Withdrawal of quotation by the vendor, at any stage after submission, may entail action. 7. If scope also includes site activities (i.e. Supervision, Erection, Installation, Testing and Commissioning of the equipment / material), separate contracts may be awarded for Supply portion and Site execution portion. For Supply portion General Terms and Conditions mentioned here shall be applicable. For Site execution portion, Terms and conditions for Installation services shall be applicable. However, any breach in either of the contract shall be deemed as the breach of other contract also.
2.	**PRICES:** **A. Prices shall remain firm during entire contract period.** **<u>Project Status</u>:** **<u>For Nabhinagar Project</u>: Mega Power Project where deemed export benefits are available as per Foreign Trade Policy of Govt. of India. Hence, ED exempted. CIF Value of import content in Ex-Works (India) price is NIL. CD benefits are not applicable.** **However, vendor shall be solely responsible for obtaining deemed export benefits from the concerned authorities and in case of failure to receive such benefits, BHEL will not compensate them in any manner, whatsoever.** **<u>For Suratgarh Project</u>: ED exempted against PAC (Project Authority Certificate by RRVUNL) and Mega Power Certificate issued by GOI.** **<u>For North Karanpura Project</u>: Mega Power Project where deemed export benefits are available as per Foreign Trade Policy of Govt. of India.** **ED exempted against PAC (Project Authority Certificate by NTPC) and Mega Power Certificate issued by GOI.** **However, vendor shall be solely responsible for obtaining deemed export benefits from the concerned authorities and in case of failure to receive such benefits, BHEL will not compensate them in any manner, whatsoever.**

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	For Foreign Bidder: **The break-up of the prices shall be as mentioned in the schedule of price format.** i. FOB / CIF (Port of loading) including sea worthy packing & forwarding charges. ii. Marine Freight. From load port to discharge port iii. Insurance. .....do..... iv. Vendor to mention Port of Loading (……..) v. Destination Port (Mumbai) **Foreign vendors to quote Freight & Insurance charges from port of loading to port of discharge (Mumbai). However, in case of insurance by foreign vendor, the beneficiary shall be BHEL only.** ***Loading shall be done on foreign vendors for* Custom Clearance charges as well as Custom Duty at Port and *for transportation from Port of Discharge to site including insurance and all other associated Charges, Taxes & duties involved till delivery of goods at site. However, foreign vendor can also quote for inland transport (From Mumbai Port to* respective *Sites).*** **Type Test charges**: As mentioned in technical specification **– The supplier shall conduct the type tests as per relevant IEC standards and no extra cost shall be paid by BHEL.** **Charges for Services Portion:** As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them. **Service Tax:** Applicable for Services Portion as per the current prevailing rate in India. **For Indigenous bidder:** 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: Exempted as mentioned above.** **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. **d) Entry tax / Octroi Charges:** Any Entry tax / Octroi applicable at destination / destination state shall be paid extra on proof of such payment. **e) Freight & Insurance:** Freight and Transit Insurance for door delivery up to destination/store is to be quoted. ***f)* Service Tax:** Applicable for Services Portion as per the current prevailing rate in India. **g) Type Test charges:** As mentioned in technical specification **– The supplier shall conduct the type tests as per relevant IEC standards and no extra cost shall be paid by BHEL.** **h) Charges for Services Portion:** As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.

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	NOTE: **The purchase order shall be placed on Ex- Works basis for Indian Vendor.** **For overseas Vendor, the order is proposed to be placed on CIF basis. However, BHEL reserves the right to convert the order on FOB also. The evaluation of bids shall be done on delivered cost to BHEL, in such case, custom duty, custom clearance charges and related expenses and the F & I charges from discharge port to site shall be loaded on CIF value quoted by the overseas vendors.** **"BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.** **In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue."** **(Further to above clause, please refer attached Annexure I for Terms & Conditions Of Reverse Auction Page 1 & 2)**
3.	**TERMS OF PAYMENT:- For Overseas Vendors:** **FOR SUPPLY PORTION**:- i) By irrevocable LC (With Usance Period of 60 days, to be counted from the date of presentation of documents in LC opening bank) which will be opened after placement of order and receipt of performance bank guarantee for 10% of order value. All bank charges to supplier's account. **90%** against original invoice, original bill of lading, packing list, MICC (dispatch clearance given by BHEL), guarantee certificate, transit insurance certificate, certificate of origin. **ii) "10% direct payment within 60 days from the date of confirmation of material receipt by BHEL Site and against submission of invoice to BHEL TBG."** **NOTE: In regards LC Payment, please note that all bank charges are in beneficiary account. Period of presentation should be 7-10 working days from the date of shipment / invoice whichever is later. However, documents must reach LC opening bank within 21 days of date of B / L.** **FOR SERVICES:**-100% direct payment within 60 days after acceptance of the services work by BHEL. **TERMS OF PAYMENT:- For Indian Vendors:** 100 % Payment with Taxes, Duties, Freight & Insurance within 60 days (**45 Days for MSE vendor**) from the date of receipt of complete invoice with following documents in 3 sets (Original + 2 copies): - LR duly endorsed in the name of customer by BHEL site - Receipt of material on the attached format by BHEL site - Excise invoice (If Applicable) - Delivery Challan or Packing list (case wise)

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	- Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers - MICC - Guarantee Certificate - Copy of Performance Bank Guarantee. [A.] Documents to be furnished by vendor immediately after dispatch: - Copy of Invoice - Copy of LR - Copy of Delivery Challan / Packing List - Copy of Insurance Certificate - Copy of Guarantee Certificate [B.] Following Documents to be sent by vendor to TBG, BHEL : - LR duly endorsed in the name of customer by BHEL site - Receipt of material on the attached format by BHEL site - Excise invoice (If Applicable) - Delivery Challan / Packing list (case wise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers - Dispatch Clearance / MICC - Guarantee certificate - All Test & Inspection Reports **FOR SERVICES:**-100% direct payment within 60 days after acceptance of the services work by BHEL. **INTEREST LIABILITY** In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment.
4	**GUARANTEE:** The equipment / material shall be guaranteed for 18 months from the date of receipt at BHEL Site or 12 months from the date of commissioning / handing over to customer, whichever is earlier. The defective material / component shall be replaced free of cost at site.
5.	**SECURITY CUM PERFORMANCE BANK GUARANTEE**: **OPTION -A** **For Overseas Vendors:** In the event of an order, tenderer shall furnish BG towards Security Cum Performance for 10% of total value of P.O.(for supply portion), within two weeks of placement of P.O. valid till 60 days beyond the guarantee period, from any schedule bank subject to acceptance by TBG/BHEL Finance **For Indian Vendors:** Bidder shall furnish along with first invoice Performance BG / deposit as per following options. BG for 10% of the total Ex-works PO value, initially valid for 18 months + 3 months claim period (i. e. total 21 months) from the date of last delivery In case BG period is expiring before expiry of Guarantee Period, vendor (applicable for both Indian as well overseas vendors) will have to keep the BG extended suitably till the end of Guarantee Period. In case of foreign vendors, BG will be required to be submitted before opening of L/C.

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	All the Bank Guarantee shall be from a scheduled bank (As Per list attached) in India acceptable to BHEL. The original BG should be sent by issuing bank directly to AGM (Finance), TBG, BHEL, Noida. BANK Guarantee should be valid for lodging claim within two months after expiry of guarantee period. **OPTION-B(Applicable for Indian as well as Overseas Vendors)** Retention of 10% of the total Ex-works PO value by BHEL from the first bill in lieu of Performance Bank Guarantee, to be released after expiry of Guarantee Period. **If no option is specified, by default option – A shall be considered for confirmation**
6.	**INSPECTION:** BHEL and/or customer may inspect the Equipment/Material before dispatch. In the event BHEL / Customer waives off inspection, TEST REPORTS and RESULTS shall be submitted by vendor for approval by BHEL / Customer. Based on that MICC (Material Inspection Clearance Certificate) / MDCC shall be issued by BHEL. Material to be dispatched only after getting Dispatch Clearance from BHEL. BHEL / Customer may also carry out stage inspection during manufacturing of the ordered item. Supplier shall send inspection call on prescribed format only with an advance notice of 15 days.
7.	**DISPATCH DOCUMENTS:** Dispatch documents (Negotiable documents) shall normally comprise Original Invoice, Bill of Lading/LR, Shipping / Packing lists (case wise), Certificate of country of origin, Material Inspection Clearance certificate (MICC), Test Certificates & approval of acceptance & routine test certificates, Insurance certificate and manufacturer's guarantee certificate.
8.	**DELIVERY PERIOD:** Bidder to specify their earliest delivery period in weeks from the date of LOI / PO in the activity schedule format enclosed with enquiry. Time for conducting the type test, if required, is to be separately indicated. Note: BOL/LR date or Invoice date whichever is later shall be considered as delivery date for supply portion and date of completion of installation work shall be considered as delivery date for installation work. **Vendors to quote the best and earliest possible delivery period.**
9.	**DELAYED DELIVERY:** In case of delay in execution of order beyond the lot wise contractual delivery, an amount of ½ % of total Ex-Works / FOB Value per week or part there-of subject **to maximum of 10 %** of total Ex-Works / FOB value of P.O. will be levied.
10.	**VALIDITY:** The offer shall be valid for 120 days from the due date of opening.
11.	**ACCEPTANCE / REJECTION OF TENDER**: BHEL reserves the right to reject in full or part, any or all tender without assigning any reason thereof. BHEL also reserves right to vary the quantities mentioned in the tender.
12.	**EVALUATION: Comparative statement shall be prepared based on overall quantity basis for all the projects. Evaluation of offers shall be done on the basis of delivered cost to BHEL. However, separate POs shall be placed for individual projects.**
13.	**DEVIATION:** The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may **load the prices for evaluation of offer as mentioned at Sl. No. - 23.**
14.	**ARBITRATION:** All cases of disputes emanating from and relating to this contract shall be referred to the sole arbitrator appointed by Unit Head / GM, BHEL. The arbitrator may be an

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	employee of BHEL whether serving or retired or any other person nominated by Unit Head/GM BHEL. The arbitration shall be in accordance with 'The Arbitration and Conciliation Act 1996' and the rules there under as amended from time to time. The arbitrator shall give a reasoned award. The decision of the arbitrator shall be final & binding upon both the parties. The venue of arbitration shall be Delhi.
15.	**LEGAL SETTLEMENT:** All disputes shall be subject to jurisdiction of court situated in Delhi/New Delhi only. Notwithstanding contained herein anything in this NIT, the original exclusive jurisdiction shall remain of the court at Delhi / New Delhi.
16.	**SUBCONTRACTING :** In case further subcontracting of BHEL order or part thereof is envisaged by vendor, the same can be done only after written permission is obtained from BHEL. However it shall not absolve the vendor of the responsibility of fulfilling BHEL purchase order requirements.
17.	**RISK PURCHASE:** In case of failure to supply or comply with the terms & conditions of the purchase order, BHEL reserves the right to source such material/ component / equipment/ system or part thereof from any other agency at the risk and cost of the vendor.
18.	**ADJUSTMENT OF RECOVERY:** Any amount payable by the supplier under any of the condition of this contract shall be liable to be adjusted against any amount payable to the supplier under any other works/contract awarded to him by any BHEL unit. This is without prejudice to any other action as may be deemed fit by BHEL.
19.	**FORCE MAJEURE CONDITION:** Force Majeure will mean: Circumstances beyond the control of contracting parties such as but not limited to act of God, natural catastrophes, fire, war, embargo, industrial dispute, riot, civil commotion, restrictions etc. Vendors willing to plead force majeure shall inform its effect on fulfillment of contract and shall not be held responsible for non performance in such circumstances.
20	**DEMURRAGE / WHARFAGE:** For the reasons of delay in receipt of documents from suppliers or due to the same being found to be incomplete, and/or faulty, the suppliers shall be responsible to reimburse in all demurrages / wharfages, if any, paid by BHEL (for stated reasons).
21	**Instructions for OEM:** Procurement directly from the manufacturers / suppliers shall be preferred. However, if the OEM / Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacture / supplier. Moreover, either the agent could bid on behalf of the manufacture / supplier or the manufacture / supplier could bid directly but not both. In case, bids are received from both the manufacture / supplier and the agent, bid received from the agent shall be ignored. Guarantee Certificate should be from OEM only. However, in case of part supply or services to be done by the agent of manufacture / supplier, two separate orders can be placed by BHEL one on OEM & other on the agent of OEM. However, System guarantee shall be provided by OEM only.
22	**Technical requirement of PQR- OPGW Cable Nabinagar** **(A)** The bidder must have supplied and installed the OPGW cable (at least 10 km) for state/ power utilities in India in any one year during the last ten years, which must be in successful operation as on the date of bid opening. AND **(B) (i)** The bidder should source the OPGW cable from a manufacturer who should have

Sr. No	**ENQUIRY NO. 275G007 DATED 22/06/2015 DUE ON 21/07/2015**
	designed, manufactured, type tested and supplied in a single contract at least 10 (ten) km of 8 Fibre or higher size OPGW cable in any one year during the last five years as on the date of bid opening. **OR (ii)** In case bidder is a manufacturer then, the bidder should have designed, manufactured, type tested and supplied in a single contract at least 10 (ten) km of 8 Fibre or higher size OPGW cable in any one year during the last five years as on the date of bid opening. **Technical requirement of PQR- OPGW Cable Suratgarh** **(A)** The bidder must have supplied and installed the OPGW cable (at least 1 km) for state/ power utilities in India in any one year during the last ten years, which must be in successful operation as on the date of bid opening. AND **(B) (i)** The bidder should source the OPGW cable from a manufacturer who should have designed, manufactured, type tested and supplied in a single contract at least 1 (one) km of 8 Fibre or higher size OPGW cable in any one year during the last five years as on the date of bid opening. **OR (ii)** In case bidder is a manufacturer then, the bidder should have designed, manufactured, type tested and supplied in a single contract at least 1 (one) km of 8 Fibre or higher size OPGW cable in any one year during the last five years as on the date of bid opening. **Technical requirement of PQR- OPGW Cable North Karanpura** **(A)** The bidder must have supplied and installed the OPGW cable (at least 10 km) for state/ power utilities in India in any one year during the last ten years, which must be in successful operation as on the date of bid opening. AND **(B) (i)** The bidder should source the OPGW cable from a manufacturer who should have designed, manufactured, type tested and supplied in a single contract at least 10 (ten) km of 8 Fibre or higher size OPGW cable in any one year during the last five years as on the date of bid opening. **OR (ii)** In case bidder is a manufacturer then, the bidder should have designed, manufactured, type tested and supplied in a single contract at least 10 (ten) km of 8 Fibre or higher size OPGW cable in any one year during the last five years as on the date of bid opening. The Bidder must ensure that they confirm the Qualifying Requirement and the necessary documentation in this regard would be provided by Bidder to BHEL along with their offer for ascertaining that they confirm the Qualifying Requirement. BHEL Reserves the Right to reject any offer from Bidder in case of Non – Compliance to the Qualifying Requirement or inability of Bidder to produce the necessary documentation for ascertaining that they confirm the Qualifying Requirement.
23	**LOADING CRITERIA FOR DEVIATIONS TAKEN BY BIDDER ON:** 23.1 : TERMS OF PAYMENT: If a bidder asks for payment within specified no. of days from the date of receipt of invoice with complete documents as per "Terms of Payment" at sr. No. 3 above, loading to be done as follows: a) Base rate of SBI (as applicable on the date of techno commercial bid opening) + 6 % shall be considered for loading for the period of relaxation sought by the bidder. b) 60 days - No loading 23.2 : DELAYED DELIVERY / PENALITY DUE TO DELAYED DELIVERY: Loading for not accepting this clause / accepting only on un delivered portion shall be the maximum amount specified in this clause.

Sr. No	**ENQUIRY NO. 275G007 DATED 22/06/2015 DUE ON 21/07/2015**
24	**Indemnity (Against Patents / Trademarks etc) :** The vendor shall at all times indemnity the purchaser against all claims which may be made in respect of the said supply from any rights protected by patent registration of design or trade mark; provided always that in the event of any claim in respect of an alleged breach of patents registered design or trademark being made against. The purchaser shall notify the seller of same and the seller shall be at liberty, but entirely at their own expenses, to conduct negotiation for settlement or deal with any litigation that may arise there from.
25	**To and fro travelling expenses, Boarding and Lodging during services shall be borne by the vendor as per span mentioned in technical specification.**
26	**CONVERSION TO SINGLE CURRENCY:** Prices expressed in currency other than Indian Rupee will be converted to Indian Rupee at the exchange rate (TT selling rate of State Bank of India) on the due date of submission of offer for the purpose of evaluation.
27	**FINAL ENGINEERING DOCUMENTATION:** Final documentation as called in the specification is to be submitted within 3 to 5 months from the date of dispatch of material at site against this contract.
28	"MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM II certificate having deemed validity (five years from the date of issue of acknowledgement in EM II) or valid NSIC certificate or EM II certificate along with attested copy of a CA certificate (Format enclosed at Annexure -1 where deemed validity of EM II certificate of five years has expired) applicable for the relevant financial year (latest audited). Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of their bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazetted officer. "

Signature of Bidder **Seal**

Terms & Conditions of Reverse Auction

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Enquiry No 275G007 Dated 22/06/2015

BHARAT HEAVY ELECTRICALS LTD.
(TRANSMISSION BUSINESS GROUP)

TERMS & CONDITIONS FOR SERVICES

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

Sl. No.	Terms & Conditions
1.0	**SCOPE OF WORK:** As per Technical Specification attached with this enquiry.
2.0	**COMMENCEMENT OF WORK**: Project start / zero date / Readiness at site for this work shall be intimated by BHEL.
3.0	**COMPLETION SCHEDULE**: Bidder to specify delivery period in weeks from the date of Project start / zero date / Readiness at site in the activity schedule format enclosed with enquiry.
4.0	**OVER RUN CHARGES**: No over run charges are payable.
5.0	**IDLE LABOUR CHARGES:** No idle labour charges will be admissible in the event of any stoppage of work resulting in the contractor's workmen being rendered idle due to any reason at any time.
6.0	**SECURITY-CUM-PERFORMANCE GUARANTEE:** The contractor shall furnish security-cum-performance BG for 10% of contract value (for Service portion) within two weeks of placement of work order valid till guarantee period from any schedule bank subject to acceptance by TBG/BHEL Finance. The original BG shall be sent by issuing bank directly to AGM - FINANCE, TBG, BHARAT HEAVY ELECTRICALS LIMITED.
7.0	**INSURANCE:** The Contractor shall take insurance cover(s) to cover his Tools and Plant assets, workman compensation and third party liability. The contractor shall make available the original insurance cover(s) to the Engineer for necessary verification before commencement of work.
8.0	**GUARANTEE:** 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.
9.0	**TERMS OF PAYMENT:** The terms of payment shall be as specified under Clause 3 of General Terms and Conditions of this Enquiry.
10.0	**ESCALATION / PRICE VARIATION:** Prices shall be firm for total contract period and extended period, if any, and no price escalation / price variation will be applicable.
11.0	**COMPENSATION FOR DELAY IN EXECUTION:** In case the contractor fails to complete the work within the time specified or any extension thereof subject to force major condition, the contractor shall be liable to pay by way of compensation, a sum

	equal to half percent (½%) of the contract price, per calendar week or part thereof by which the commissioning is delayed, subject to a ceiling of 10% of the contract price.
12.0	**ADDITIONAL EXPENDITURE:** In case any additional expenditure is incurred in the works arising out of the faulty execution of the works by the contractor, such additional expenditure shall be borne by the contractor.
13.0	**REGULATION OF LOCAL AUTHORITIES AND STATUS :** The contractor shall adhere to the regulation of local authorities and status.
14.0	**DISCIPLINE OF WORKMEN:** The contractor shall adhere to the disciplinary procedure set by the owner in respect of his employees and workman at site.
15.0	**FORCE MAJEURE:** The force majeure shall be as specified under Clause 19 of General Terms and Conditions of this Enquiry.
16.0	**ARBITRATION:** The arbitration shall be as specified under Clause 14 of General Terms and Conditions of this Enquiry.

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

BHEL UN-PRICE BID FORMAT FOR SUPPLY PORTION.

Enquiry No: 275G007 dated 22/06/2015
Project: NPGCPL NABHINAGAR STPP
item: OPGW Cable & Accessories

S.N.	PI-ITEM	Unit	Qty	Currency	Unit Ex-works/ FOB	Total Ex-works/ FOB	Unit Marine Freight & Insurance	Total Marine Freight & Insurance	Unit Inland F & I Charges	Total Inland F & I Charges	Excise Duty, if applicable as per NIT (ED)		Central Sales Tax (CST)		Total Cost to BHEL for indian supplier for each line item	CIF Value + Inland F & I (if opted by foreign bidder)
Instrcution to bidder--------->							1. Applicable only for foreign bidder. 2. Quoted prices of marine freight & insurance is inclusive of all taxes & duties		Quoted prices of inland freight & insurance is inclusive of all taxes & duties		Rate of Excise Duty (in Percentage)	Amount of Excise Duty	Rate of CST (in Percentage)	Amount of CST	Bidder to indicate prices in price bid of BHEL's Format & mention QUOTED / NOT QUOTED OR NOT APPLICABLE of each & every cell	
Applicable formula to bidder--------->			(0)		(1)	(2) = (1) X (0)	(3)	(4) = (3) X (0)	(5)	(6) =(5) X (0)	(7) = (.....%)	(8) = (7) x2	(9) = (.... ...%)	(10) = ((8) + (2)) x (9)	(11) = [(2)+ (6) + (8) + (10)] [EX-WORKS+ INLAND F & I + ED + CST]	['(12)=(2)+ (4) + (6)] FOB+ SEA F & I + INLAND F & I]
1	12 Fibre OPGW cable	Km	11													
2	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	19													
3	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	28													
4	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	34													
5	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	62													
6	OPGW cable Accessories – Armor Rods for OPGW	Nos.	19													
7	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	7													
8	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1													
9	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1													
10	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2													
A	**Total Ex-works / FOB =**															
B	**Total Sea freight & Insurance =**															
C	**Total Inland freight & insurance charges =**															
D	**Total excise duty =**															
E	**Total central sales taxes =**															
	Total cost to BHEL for Indian supplier in Indian Currency (A + C + D + E)=															
	CIF Value + Inland F & I (if opted by foreign bidder) (A + B + C) =															

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

BHEL UN-PRICE BID FORMAT FOR SERVICE PART

Enquiry No: 275G007 dated 22/06/2015
Project: NPGCPL NABHINAGAR STPP
item: OPGW Cable & Accessories

S.N	PI-ITEM	Unit	Qty	Currency	Unit Charges	Total Charges	Service taxes, if applicable in INDIA		Total Cost to BHEL for indian supplier for each line item	Total cost to BHEL for foreign supplierfor each line item
	Instrcution to bidder--------->						Bidder to indicate percentage for each line item	Value		
	As per BOQ of technical specification of NIT		(0)		(1)	(2) = (1) X (0)	(3) =.....% of (2)	(4)	['(5) =(2)+ (4)] [TOTAL CHARGES + SERVICE TAX]	['(6)=(2)+ (4)] [TOTAL CHARGES + SERVICE TAX]
1	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	33							
2	Termination & splicing of OPGW cable and approach cable	Lot	1							
3	Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Set	1							
A	**Total Charges =**									
B	**Total Service Taxes =**									
	Total cost to BHEL for service portion in case of Indian supplier in Indian Currency (A + B)=									
	Total cost to BHEL for service portion in case of foreign supplier in foreign currency (A + B) =									

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

BHEL UN-PRICE BID FORMAT FOR SUPPLY PORTION.

Enquiry No: 275G007 dated 22/06/2015
Project: RRVUNL SURATGARH
item: OPGW Cable & Accessories

S.N.	PI-ITEM	Unit	Qty	Currency	Unit Ex-works/ FOB	Total Ex-works/ FOB	Unit Marine Freight & Insurance	Total Marine Freight & Insurance	Unit Inland F & I Charges	Total Inland F & I Charges	Excise Duty (ED)		Central Sales Tax (CST)		Total Cost to BHEL for indian supplier for each line item	CIF Value + Inland F & I (if opted by foreign bidder)
Instrcution to bidder--------->							1. Applicable only for foreign bidder. 2. Quoted prices of marine freight & insurance is inclusive of all taxes & duties		Quoted prices of inland freight & insurance is inclusive of all taxes & duties		Rate of Excise Duty (in Percentage)	Amount of Excise Duty	Rate of CST (in Percentage)	Amount of CST	Bidder to indicate prices in price bid of BHEL's Format & mention QUOTED / NOT QUOTED OR NOT APPLICABLE of each & every cell	
Applicable formula to bidder--------->			(0)		(1)	(2) = (1) X (0)	(3)	(4) = (3) X (0)	(5)	(6) =(5) X (0)	(7) = (.....%)	(8) = (7) x2	(9) = (.... ...%)	(10) = ((8) + (2)) x (9)	(11) = [(2)+ (6) + (8) + (10)] [EX-WORKS+ INLAND F & I + ED + CST]	['(12)=(2)+ (4) + (6)] FOB+ SEA F & I + INLAND F & I]
1	12 Fibre OPGW cable	Km	2.1													
2	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	2													
3	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	12													
4	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	9													
5	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	12													
6	OPGW cable Accessories – Armor Rods for OPGW	Nos.	2													
7	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	4													
8	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1													
9	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1													
10	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2													
A	**Total Ex-works / FOB =**															
B	**Total Sea freight & Insurance =**															
C	**Total Inland freight & insurance charges =**															
D	**Total excise duty =**															
E	**Total central sales taxes =**															
	Total cost to BHEL for Indian supplier in Indian Currency (A + C + D + E)=															
	CIF Value + Inland F & I (if opted by foreign bidder) (A + B + C) =															

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

BHEL UN-PRICE BID FORMAT FOR SERVICE PART

Enquiry No: 275G007 dated 22/06/2015
Project: RRVUNL SURATGARH
item: OPGW Cable & Accessories

S.N	PI-ITEM	Unit	Qty	Currency	Unit Charges	Total Charges	Service taxes, if applicable in INDIA		Total Cost to BHEL for indian supplier for each line item	Total cost to BHEL for foreign supplierfor each line item
	Instrcution to bidder--------->						Bidder to indicate percentage for each line item	Value		
	As per BOQ of technical specification of NIT		(0)		(1)	(2) = (1) X (0)	(3) =.....% of (2)	(4)	['(5) =(2)+ (4)] [TOTAL CHARGES + SERVICE TAX]	['(6)=(2)+ (4)] [TOTAL CHARGES + SERVICE TAX]
1	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	8							
2	Termination & splicing of OPGW cable and approach cable	Lot	1							
3	Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Set	1							
A	**Total Charges =**									
B	**Total Service Taxes =**									
	Total cost to BHEL for service portion in case of Indian supplier in Indian Currency (A + B)=									
	Total cost to BHEL for service portion in case of foreign supplier in foreign currency (A + B) =									

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

BHEL UN-PRICE BID FORMAT FOR SUPPLY PORTION.

Enquiry No: 275G007 dated 22/06/2015
Project: NTPC North Karanpura
item: OPGW Cable & Accessories

S.N.	PI-ITEM	Unit	Qty	Currency	Unit Ex-works/ FOB	Total Ex-works/ FOB	Unit Marine Freight & Insurance	Total Marine Freight & Insurance	Unit Inland F & I Charges	Total Inland F & I Charges	Excise Duty (ED)		Central Sales Tax (CST)		Total Cost to BHEL for indian supplier for each line item	CIF Value + Inland F & I (if opted by foreign bidder)
Instrcution to bidder--------->							1. Applicable only for foreign bidder. 2. Quoted prices of marine freight & insurance is inclusive of all taxes & duties		Quoted prices of inland freight & insurance is inclusive of all taxes & duties		Rate of Excise Duty (in Percentage)	Amount of Excise Duty	Rate of CST (in Percentage)	Amount of CST	Bidder to indicate prices in price bid of BHEL's Format & mention QUOTED / NOT QUOTED OR NOT APPLICABLE of each & every cell	
Applicable formula to bidder--------->			(0)		(1)	(2) = (1) X (0)	(3)	(4) = (3) X (0)	(5)	(6) =(5) X (0)	(7) = (.....%)	(8) = (7) x2	(9) = (.... ...%)	(10) = ((8) + (2)) x (9)	(11) = [(2)+ (6) + (8) + (10)] [EX-WORKS+ INLAND F & I + ED + CST]	['(12)=(2)+ (4) + (6)] FOB+ SEA F & I + INLAND F & I]
1	12 Fibre OPGW cable	Km	12.6													
2	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	27													
3	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	38													
4	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	47													
5	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	88													
6	OPGW cable Accessories – Armor Rods for OPGW	Nos.	27													
7	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	8													
8	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1													
9	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1													
10	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2													
A	**Total Ex-works / FOB =**															
B	**Total Sea freight & Insurance =**															
C	**Total Inland freight & insurance charges =**															
D	**Total excise duty =**															
E	**Total central sales taxes =**															
	Total cost to BHEL for Indian supplier in Indian Currency (A + C + D + E)=															
	CIF Value + Inland F & I (if opted by foreign bidder) (A + B + C) =															

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

BHEL UN-PRICE BID FORMAT FOR SERVICE PART

Enquiry No: 275G007 dated 22/06/2015
Project: NTPC North Karanpura
item: OPGW Cable & Accessories

S.N	PI-ITEM	Unit	Qty	Currency	Unit Charges	Total Charges	Service taxes, if applicable in INDIA		Total Cost to BHEL for indian supplier for each line item	Total cost to BHEL for foreign supplierfor each line item
Instrcution to bidder--------->							Bidder to indicate percentage for each line item	Value		
	As per BOQ of technical specification of NIT		(0)		(1)	(2) = (1) X (0)	(3) =.....% of (2)	(4)	['(5) =(2)+ (4)] [TOTAL CHARGES + SERVICE TAX]	['(6)=(2)+ (4)] [TOTAL CHARGES + SERVICE TAX]
1	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	46							
2	Termination & splicing of OPGW cable and approach cable	Lot	1							
3	Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Set	1							
A	**Total Charges =**									
B	**Total Service Taxes =**									
	Total cost to BHEL for service portion in case of Indian supplier in Indian Currency (A + B)=									
	Total cost to BHEL for service portion in case of foreign supplier in foreign currency (A + B) =									

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

TRANSMISSION BUSSINESS GROUP
MATERIAL MANGEMENT
BHEL, NOIDA

ACTIVITY SCHEDULE

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

ENQUIRY NO. 275G007 DATE: 22/06/2015

PROJECT: STPP NABINAGAR

ITEM: OPGW CABLE & ACCESSORIES

VENDOR : OFFER REF.

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

Total time in vendor's scope:

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

SIGNATURE AND SEAL

TRANSMISSION BUSSINESS GROUP
MATERIAL MANGEMENT
BHEL, NOIDA

ACTIVITY SCHEDULE

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

ENQUIRY NO. 275G007 DATE: 22/06/2015

PROJECT: NORTH KARNPURA

ITEM: OPGW CABLE & ACCESSORIES

VENDOR : OFFER REF.

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

Total time in vendor's scope:

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

SIGNATURE AND SEAL

TRANSMISSION BUSSINESS GROUP
MATERIAL MANGEMENT
BHEL, NOIDA

ACTIVITY SCHEDULE

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

ENQUIRY NO. 275G007 DATE: 22/06/2015

PROJECT: RRVUNL SURATGARH

ITEM: OPGW CABLE & ACCESSORIES

VENDOR : OFFER REF.

SL. NO.	ACTIVITY	ACTIVITY TIME IN WEEKS	REMARKS IF ANY
1.	Receipt of P.O		
2.	P.O Acceptance	ONE WEEK	Vendor must Submit Po acceptance with in one week
3.	Submission of documents necessary for getting manufacturing clearance like Drawings, data sheet, QAP etc.		Documents complete in all respect are to be Submitted. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier
4.	Review and Approval of documents and issue of manufacturing clearance	BHEL ACTIVITY	Vendor must ensure to reply all queries expeditiously.
5.	Manufacturing Time **[FOR CABLES & ACCESSORIES]**		Manufacturing time be indicated considering all constrains & must include time required for internal inspections etc.
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7	Inspection	BHEL	
8	Issue of MICC, MDCC & other documents like EDEC , Road permits etc	BHEL	Vendor must indicate requirement well in advance.
9	Dispatch	ONE WEEK	Vendor must ensure to dispatch with in one Week of receiving all documents required
10	Services		(Please refer clause no. – 3 of terms and conditions for services portion and kindly quote accordingly for completion of service work)

Total time in vendor's scope:

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

SIGNATURE AND SEAL

ENQUIRY NO. 275G007 DATE: 22/06/2015

CHECKLIST

SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

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

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

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

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal ……..

Date ……..

SCHEDULE OF COMMERCIAL DEVIATION

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

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

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

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

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

Place ……..

Date ……..

Signature of the authorized representative of

Bidder's Name ……

Designation ……..

Company seal ……

SCHEDULE OF TECHNICAL DEVIATION

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

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

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

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

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

Place ……..

Date ……..

Signature of the authorized representative of

Bidder's Name …….

Designation ……..

Company seal …….

(Revised Format)

DKM1551RK9/DS

10/06/15

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESSS GROUP
MATERIAL RECEIPT CERTIFICATE

a) Site:
b) LR No. with date:
c) Vehicle no.:
d) Date of receipt of material at site:
e) Material details (as mentioned below):

S.no.	Item Description	Type of Packages	Unit (MT/KM/ NO.)	Qty as per packing list	Qty Received	Remarks

Other Remarks:

Signature with date: _____

Name & Designation: _____
(With Seal)

INSPECTION REQUEST

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

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

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

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

Signature
Name :
Contact No. :
Date :

Distribution :

1. Material Management , BHEL, New Delhi

Note :

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

Annexure - I

Certificate by Chartered Accountant on letter head

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

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

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

(Strike off whichever is not applicable)

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

Or

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

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant

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

APPENDIX-Q1

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

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

_____ Tel_____

_____ Mobile_____

_____ e-mail_____

_____ Fax_____

3. Address of Factory/Works

_____ Tel_____

_____ Mobile_____

_____ e-mail_____

_____ Fax_____

Weekly off day

4. Branch/Liaison Office in Delhi:

_____ Tel_____

_____ Mobile_____

_____ e-mail_____

_____ Fax_____

Weekly off day

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

5. Person(s) to be contacted

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

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

Works Details:

7. Year of Factory Establishment :

8. Year of Commencement of Manufacture :

9. Total Area/Covered Area

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

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

12. Do you have in-house Department for :

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

13. Shift works per day One/Two/Three

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

14. Details regarding employees :

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

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

16. Trade Name of Product (if any) :

17. Manufacturing capacity details :

S. N.	Product	Licensed Capacity	Installed Capacity

18. Brief details of items manufactured :

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

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

19.Details of foreign collaboration, if any :

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

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

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

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

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

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

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

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

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

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

50

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

24(a) Specific to process & product facilities :

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

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

24(b) Other/General facilities .

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

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

25 (a) Facilities for Testing & Inspection :

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

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

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

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

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

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

53

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

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

a) Type Source

b) Raw material storage & identification :

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

29. Quality management

29.1 General

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

29.1.2. Head of QC Department reports to :

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

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

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

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

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

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

29.1.9. Whether 100% or adequate sampling inspection used?

29.1.10. Are statistical quality control techniques used?

29.2. Corrective Action

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

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

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

29.2.4. Does corrective action extend to products?

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

29.3 **Documentation Control**

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

29.3.2. Are changes made in writing?

29.4. Control of Inspection, measuring & Testing equipments

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

29.4.2. Are testing and measuring equipment properly maintained?

29.4.3. Is recorded control on calibration of equipment available?

29.5. Control of procured supplies & Services

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

29.5.2. Do purchasing documents also contain special requirements?

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

30. CONSISTENCY IN SUPPLY

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

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

30.3. Has there been frequent labour trouble in past?

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

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

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

If Yes, the name of sub-vendors :

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

a) Value :

b) Time :

32. Any special information

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

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

SEAL

SIGNATURE_____
NAME_____
DESIGNATION_____
M/S._____
PLACE_____
DATE_____

LIST OF ENCLOSURE

1.
2.
3.

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

Name : Designation : Signature : Date :

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

Name : Designation : Signature : Date :

1.
2

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MAIN SUPPLIES'S EVALUATION REPORT

(For Proposed Sub-Supplier)

APPENDIX-Q2

MAIN SUPPLIER M/S.....

PACKAGE & PROJECT :

EQUIPMENT / ITEM :

GENERAL INFORMATION

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

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

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

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

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

5. RECOMMENDATIONS :

NAME _____ DESIGN _____ SIGN.: _____

List of Encl.

Date : _____

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APPENDIX-Q3

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

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

MANUFACTURER/ SUB-SUPPLIER	MAIN SUPPLIER
SIGNATURE	

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

FOR NTPC USE

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

FORMAT NO.: QS-01-QAI-P-09/F1-R1 1/1 ENGG. DIV./QA&I

APPENDIX B
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APPENDIX-Q5

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

SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	10.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

LEGEND: * RECORDS INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
LEGEND TO BE USED: CLASS # ; A = CRITICAL, B=MAJOR, C=MINOR;
'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

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FOR NTPC USE

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

FORMAT NO.: QS-01-QA1-P-09/F2-R1 | 1/1 | ENGG. DIV./QA&I

APPENDIX 13
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(ON RS.100/- NON - JUDICIAL STAMP PAPER)

PROFORMA FOR SECURITY-CUM-PERFORMANCE GUARANTEE

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

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

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

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

NOW THIS DEED WITNESSES AS FOLLOWS :

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

(Contd....2.)

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

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

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

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

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

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

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

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

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

SIGNED FOR AND ON
BEHALF OF THE BANK

WITNESSESS

Name and Address **Signature**

1. **……**
……
……
……
……

2. **……**
……
……
……
……

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

DOCUMENT No.	TB 350 510 032	Rev 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	VSM	RD	VK
TITLE		SIGN			
		DATE	29/4/14		29/4
OPGW ALONGWITH ACCESSORIES		GROUP	TBEM	W.O. No	NB-81004 SG-83001 NK-83011

CUSTOMER	**1.NABINAGAR POWER GENERATING CO. PVT. LIMITED (NPGC)** (A Joint Venture of NTPC Ltd. And Bihar State Electricity Board) **2.Rajasthan Rajya Vidyut Utpadan Nigam Ltd, Jaipur** **3. National Thermal Power Corporation Ltd**
CONSULTANT	**----**
PROJECT	**1. 400/132 KV SWITCHYARD PACKAGE AT NABINAGAR SUPER THERMAL POWER PROJECT (3 X 660 MW)** **2. 2X660MW SUPER –CRITICAL THERMAL POWER STATION, STAGE – V, UNIT 7 & 8 - 400KV SWITCHYARD AT SURATGARH** **3. NORTH KARANPURA SUPER TPP (3X660MW)**

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2. 2X660MW Super –Critical Thermal Power Station, Stage – V, Unit 7 & 8 - 400kV Switchyard at Suratgarh
3. North Karanpura Super TPP (3x660MW)

Bharat Heavy Electricals Limited
Document No. TB 350 510 032
Technical Specification: OPGW

SECTION 1
SCOPE AND QUANTITIES

1. SCOPE

This technical specification covers the requirements of design, manufacture, testing at works, packing, dispatch, supervision of erection and site testing of Overhead Optical-fibre Power-line Grounding Wire (OPGW) complete with accessories as listed under this specification.

OPGW cable is required for communication between following S/s

1. 400/132kV S/S at Nabinagar STPP (customer NPGC) and 400/132kV S/S at Nabinagar TPP (customer BRBCL). The two ends are around 11km apart and connected through 400kV Transmission Lines.
2. 400 kV D/C Transmission Line, Suratgarh, The two ends are around 2km apart and connected through 400kV Transmission Lines.
3. 220kV D/C Transmission line between 400/220kV switchyard at North Karanpura STPP & 220kV substation at Chatti Bariatu & Kerandari-A mine. The two ends are around 12km apart and connected through 400kV Transmission Lines.

   Main purpose presently is data communication between current differential protection relays at the two ends.

This section covers the specific technical requirements of OPGW. This constitutes minimum technical parameters for the above item as specified by the customers. The offered equipment shall also comply with the General Technical Requirements for the project as detailed under section-3 of this specification.

The specification comprise of following sections:
Section-1: Scope & Bill of Quantities
Section-2: Equipment Specification
Section-3: General Technical Requirements
Section-4: GTP
In case of any conflict between various sections, **order of precedence** shall be in the same order as listed above.

2. THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECTS

1. Name of customer: Nabinagar Power Generating Co. Pvt. Limited (NPGC) (A Joint Venture of NTPC Ltd. And Bihar State Electricity Board)

Name of consultant : ---------

Name of Project: 400/132 kV Switchyard Package at Nabinagar Super Thermal Power Project (3 X 660 MW)

2. Name of customer : Rajasthan Rajya Vidyut Utpadan Nigam Ltd, Jaipur

Name of consultant : Tata consulting Engineer Ltd, Bangalore

Name of the project : 2X660MW Super –Critical Thermal Power Station, Stage – V, Unit 7 & 8 - 400kV Switchyard at Suratgarh

3. Name of customer : National Thermal Power Corporation Ltd

Name of consultant : ---------

Name of the project : North Karanpura Super TPP (3x660MW)

Refer Section - 3 for Project Details and General Specifications.

3. BILL OF QUANTITIES-

I. For *400/132 kV Switchyard Package at Nabinagar Super Thermal Power Project (3 X 660 MW)*

Sl. No.	Item Description	Unit	Quantity
1.	**12 Fibre OPGW cable**	Km	11
2.	**OPGW cable Accessories – Installation Hardware set for 12 fibre OPGW Cable consisting of following:**		
i.	OPGW Suspension Clamps	Nos.	19**
ii.	OPGW Tension Clamps (Single, with earthing bonds)	Nos.	28**
iii.	OPGW Grounding and Parallel Groove Clamps	Nos.	34**
iv.	OPGW Vibration Dampers	Nos.	62**
v.	Armor Rods for OPGW	Nos.	19**
vi.	Way Joint Box for OPGW	Nos.	7**
vii.	12 fibre Underground armoured fibre optic approach cable	Km	1
viii.	Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1*
ix.	Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2
3.	**Services consisting of following:**		
i.	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	33
ii.	Termination & splicing of OPGW cable and approach cable	Lot	1
iii.	Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Lot	1

* **Note 1 -** One set of installation hardware shall contain all insulation hardware fittings as may be required for 1 Km fibre optic approach cable.

**** Note 2 -** The quantity of OPGW cable Accessories have been calculated on the basis of tower spotting data. However, the quantity shall be adjusted as per the actual requirement. Any Other hardware & fittings such as Earthing clamps, downlead clamps etc. required for installation of OPGW cables shall also be provided as required. Quantity mentioned above is subject to change by ±10% at contract stage.`

II. For *2X660MW Super –Critical Thermal Power Station, Stage – V, Unit 7 & 8 - 400kV Switchyard at Suratgarh*

Sl. No.	Item Description	Unit	Quantity
1.	**12 Fibre OPGW cable**	Km	2.1
2.	**OPGW cable Accessories – Installation Hardware set for 12 fibre OPGW Cable consisting of following:**		
i.	OPGW Suspension Clamps	Nos.	2**
ii.	OPGW Tension Clamps (Single, with earthing bonds)	Nos.	12**
iii.	OPGW Grounding and Parallel Groove Clamps	Nos.	9**
iv.	OPGW Vibration Dampers	Nos.	12**
v.	Armor Rods for OPGW	Nos.	2**
vi.	Way Joint Box for OPGW	Nos.	4**
vii.	12 fibre Underground armoured fibre optic approach cable	Km	1
viii.	Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1*****
ix.	Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2
3.	**Services consisting of following:**		
i.	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	8
ii.	Termination & splicing of OPGW cable and approach cable	Lot	1
iii.	Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Lot	1

* **Note 1 -** One set of installation hardware shall contain all insulation hardware fittings as may be required for 1 Km fibre optic approach cable.

**** Note 2 -** The quantity of OPGW cable Accessories have been calculated on the basis of tower spotting data. However, the quantity shall be adjusted as per the actual requirement. Any Other hardware & fittings such as Earthing clamps, downlead clamps etc. required for installation of OPGW cables shall also be provided as required. Quantity mentioned above is subject to change by ±10% at contract stage.

III. For *North Karanpura Super TPP (3x660MW)*

Sl. No.	Item Description	Unit	Quantity
1.	**12 Fibre OPGW cable**	Km	12.6
2.	**OPGW cable Accessories – Installation Hardware set for 12 fibre OPGW Cable consisting of following:**		
i.	OPGW Suspension Clamps	Nos.	27**
ii.	OPGW Tension Clamps (Single, with earthing bonds)	Nos.	38**
iii.	OPGW Grounding and Parallel Groove Clamps	Nos.	47**
iv.	OPGW Vibration Dampers	Nos.	88**
v.	Armor Rods for OPGW	Nos.	27**
vi.	Way Joint Box for OPGW	Nos.	8**
vii.	12 fibre Underground armoured fibre optic approach cable	Km	1
viii.	Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1*
ix.	Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtails and FCPC coupling	Nos.	2
3.	**Services consisting of following:**		
i.	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	46
ii.	Termination & splicing of OPGW cable and approach cable	Lot	1
iii.	Supervision of Site acceptance tests including arrangement of all necessary testing equipments during testing	Lot	1

* **Note 1 -** One set of installation hardware shall contain all insulation hardware fittings as may be required for 1 Km fibre optic approach cable.

**** Note 2 -** The quantity of OPGW cable Accessories have been calculated on the basis of tower spotting data. However, the quantity shall be adjusted as per the actual requirement. Any Other hardware & fittings such as Earthing clamps, downlead clamps etc. required for installation of OPGW cables shall also be provided as required. Quantity mentioned above is subject to change by ±10% at contract stage.

4. TYPE TEST REQUIRMENTS

At contract stage, the reports for all type tests shall be submitted for end costumer approval. The type tests conducted earlier should have either been conducted in accredited laboratory (accredited base on ISO / IEC Guide 25 / 17025 or EN 45001 by the national accredition body of the country where laboratory is located) or witnessed by the representatives(s) of end costumer or Utility. The test-reports submitted shall be of the tests conducted within last five years from 29.06.2011. In case the test reports are of the tests conducted earlier than five years from 29.06.2011, the bidder shall repeat these test(s) at no extra cost to the purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable to end costumer due to any design / manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the Technical Specification on any/all additional type tests not carried out, same shall be carried out without any additional cost implication to the Purchaser.

5. INSPECTION, TESTING AND ACCEPTANCE

Bidder has to follow specification and end costumer approved Manufacturing Quality Plan.

6. DEVIATION

The bidder shall list all the deviation from the specification separately. Offers without specific deviation will be deemed to be totally in compliance with the specification and NO DEVIATION on any account will be entertained at a later date.

SECTION - 2

EQUIPMENT SPECIFICATION

Clause No.	TECHNICAL REQUIREMENTS
7.02.05	Pins and Caps: Pins and Caps shall be made of drop forged steel and malleable cast iron/spheriodal graphite iron/drop forged steel respectively, duly hot dip galvanised and shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material.
7.02.06	Security Clips: Security clips shall be made of good quality stainless steel or phosphor bronze as per IS:1385-1968 2.5% extra Security clip shall be provided.
7.03.00	**Hot Line Maintenance** The insulators offered shall be suitable for employment of hot line maintenance technique so that the usual hot line operations can be carried out with ease, speed and safety. Bidders shall indicate the methods generally used in the routine hot and dead line maintenance of HV lines for which similar insulator have been supplied by them. Bidders shall also indicate the recommended periodicity of such maintenance.
7.04.000	**OPGW and its accessories**
7.04.01	General This specification covers the provision of one peak of 400 kV tower with Optical Fiber (OPGW). This optical fiber cable will be connected to suitable optical line terminal ~~and multiplex equipment~~ to form part of the Plant's overall communications transmission system. Any expected variation shall be clearly identified in the Bidder's Proposal.
7.04.02	Construction The OPGW shall be composed of a layer of aluminum-clad steel wires around a seamless aluminum tube or stainless steel tube. The Optical core, in order to protect the fibers from external forces, shall be laid loose inside buffer tubes. The optical core shall be filled with hydrogen absorbent and water blocking filling compound. The optical fiber itself shall be manufactured by using high grade silica to provide the required performance.
7.04.03	Optical Fiber Characteristics Optical fiber shall be supplied in accordance with ITU – T Recommendation G.652 with the following requirements. Profile of Optical Fiber: Single mode stepped index Average Transmission Loss: At wavelength 1310 ηm: 0.38 dB per km maximum At Wavelength 1550 ηm: 0.25 dB per km maximum Number of Fiber: 12 Average splicing loss: 0.05db per joint Maximum splicing loss: 0.10 dB per joint Mode field diameter (MFD): 9.0μm ± 1.0μm Cladding diameter: 125 ± 2 μm Core / Cladding

	Mode field concentricity error:			1μm
	Chromatic – dispersion coefficient @ 1310 ηm			3.5 ps / ηm km. Maximum
	Chromatic – dispersion coefficient @ 1550 ηm			20 ps / ηm km. Maximum
	Fiber Identification:			each fiber shall be uniquely Identifiable throughout the Length of the wire.
	Operating Temperature:			0°C to 80 °C continuously
7.04.04	OPGW Characteristics			
	Ultimate tensile strength	(kg)	≥	7,500
	Outside diameter	(mm)	≤	14
	Cross sectional area of Conduct	(mm^2)	≥	80
	D.C. Resistance @ 20 °C	(Ω/km)	≤	0.76
	Length per reel	(m)		3000 Approx.
	Modulus of elasticity	(kg/mm^2)	≥	10,000
	Coefficient of linear expansion	(/°C)	≤	15.0×10^{-6}
	Capacity fault current $(KA)^2$ sec.			46
	Maximum allowable temp. For optical fiber in loose type (°C)			160
	Maximum Transmission Loss Change – Temperature Range 0°C to 150 °C	(dB/km)		0.1
	Unit Weight	(kg./km)	≤	600
	The Bidder shall design the OPGW requirements to suit each span in the system, based on the applicable drawings and field surveys. The Bidder's proposal shall stipulate the characteristics of the OPGW required for each span in the system.			
7.04.05	Assemblies and Line Accessories			
	a. General			
	The OPGW assemblies and line accessories shall consist of the hardware indicted herein. All hardware and accessories shall be made of aluminum, aluminum alloy, malleable iron, steel (metal mold of drop forging process), stainless steel, or non-ferrous metal, unless otherwise specified. In addition, all hardware and accessories shall have an ultimate tensile strength equal to or exceeding the rated ultimate tensile strength of the overhead ground wire. All metal shall be free from burrs, sharp edges, lumps and dross and shall be smooth so that interconnecting parts will fit properly, and so that the parts maybe assembled and readily.			
	All bolts and other fasteners shall be installed according to manufacturer's recommendations. Materials no specifically covered herein by detailed specifications shall be of standard commercial quality suitable for the intended use. The Contractor shall determine the most suitable type of clamp to be used at each and every transmission tower location.			
	b. Suspension Clamps			

The suspension clamps for the OPGW shall be of bolt or performed type. The bolt type suspension clamps shall be complete with bolts, keeper pieces, and other required parts. Each clamp shall be capable of holding the OPGW without slipping under an unbalanced tension of 25% of the ultimate tensile strength of the OPGW.

c. Tension Clamps

The tension clamps shall be of bolt or performed type, and cable of holding the OPGW without slipping or damaging the OPGW under a tension of 75% of the OPGW ultimate tensile strength. A suitable piece shall be of same material as the clamp body. Bolts, nuts and washers shall be hot-dipped galvanized malleable iron or steel.

d. Grounding clamps and Parallel Groove Clamp

Each clamp shall be capable holding the OPGW using bolts and nuts.

e. Vibration dampers

Stockbridge type vibration dampers, suitable for use on the OPGW shall be supplied. The dampers shall have an aluminum, clamping bolts, or other suitable device, on the galvanized wire between the weights, and be suitable for attachment to the OPGW. The damper clamp shall be designed to permit installation and removal using hot line tools. Each damper weight, subject to the accumulation of moisture, shall be provided with one drain hold positioned at the bottom of the weight when the damper is installed in the vertical plane. Damper weights shall be made of hot dip galvanized case iron or zinc.

f. Armor rods

The armor rods for the OPGW shall be of the preformed type. They shall be smooth and fee from corrosion, splitting, cracking, or any other defects. They shall be designed to effectively protect the OPGW from fatigue caused by vibration.

Armor rods may or may not be employed, as per OPGW manufacturer recommendations, however the use of armor rods is preferred by the Employer.

g. The joint box shall be air-tight, water-proof. The cover shall be securely fastened to the case by non-loosening fasteners. Both the case and the cover shall be made of non-corrosive aluminum alloy or hot dip galvanized steel or approved materials. The joint box shall be sufficiently rugged and sturdy to withstand outdoor climatic and environmental conditions. The joint box shall accommodate sheath protected arc-fusion splices and up to 1.5 m of additional fiber on each side of the splice; guides shall be provided to keep the extra fiber well above the allowable bending radius of the fiber. The spliced parts of the optical fiber within the joint box shall be reinforced and free from tension after completion of the splicing.

The contractor shall provide one set of terminating materials with every joint box for optical fiber connection.

1. Way Joint Box for OPGW

This type of joint box shall be used to straight joint OPGW to OPGW, or OPGW to approach cable. It shall be used at all locations requiring such a device except those specified otherwise in the text or drawings elsewhere in this specification.

2. **Way Joint Box for OPGW and approach cable**

This type of joint box shall be used to spur joint all fibers contained in two OPGW cables to OPGW or one multi-core optical fiber cable at each terminal station, repeater station, or other location, as detailed in the text or drawings elsewhere in this specification.

CHAPTER – T5 : TESTS FOR 400KV TL. LINE MATERIAL

1.00.00 GENERAL REQUIREMENTS

1.01.00 The materials shall conform to all the type tests as per relevant standards. The following type, acceptance, routine tests and tests during manufacturer shall be carried out on the line material.

1.02.00 The type tests shall be carried out on samples prior to commencement of commercial production against the specification.

1.03.00 The standards and norms to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this specification, the norms and procedure of these shall be as specified in annexure to this section.

1.04.00 For all type and acceptance tests, the acceptance values shall be the values guaranteed by the Bidder in his bid or the acceptance value specified in the relevant standard, whichever is more stringent for that particular test.

2.00.00 TYPE TESTS

All the equipment shall conform to the type tests. As specified at clause elsewhere, Contractor shall submit reports of all the type tests as mentioned below as per the relevant standards for Owner's review. The type test reports shall be of the tests conducted in last 5 years prior to the date of bid opening. For the tests whose reports submitted are not acceptable or are not furnished, the same shall be conducted by the Contractor under this contract free of charge prior to the dispatch of the equipment/material.

2.01.00 Earthwire
- a) UTS test - As per specification enclosed
- b) DC resistance test - As per specification enclosed

2.02.00 Conductor (specification of following tests enclosed at Annexure)
- a) UTS test on stranded conductor - As per specification enclosed
- b) DC resistance test on stranded conductor - As per specification enclosed

2.03.00 Conductor and Earthwire Accessories

2.03.01 Mid Span Compression Joint for Conductor and Earthwire
- a) Electrical Resistance Test – As per IS : 2121 - (Part-II) - 1981
- b) Heating Cycle Test – As per IS:2486 (Part-I, 1971) (not applicable to mid span compression joint for earthwire).
- c) Slip Strength Test - As per IS: 2486(part-I)-1971
- d) Chemical analysis of material

2.03.02 Repair Sleeve for conductor
- a) Chemical analysis of material

Clause No.	TECHNICAL REQUIREMENTS
2.03.03	Spacer for Line
a)	Chemical analysis of materials
b)	Clamp slip test
c)	Vibration tests
	i) Vertical vibration
	ii) Longitudinal vibration
	iii) Sub span oscillation
d)	Magnetic power loss test (if applicable)
e)	Tension – Compression test
f)	Corona extinction voltage test (dry)
g)	Radio interference voltage test (dry)
h)	Ozone test
	As per specification enclosed
2.03.04	Rigid Spacer for jumper (For Twin ACSR 'MOOSE')
a)	Chemical analysis of materials
b)	Clamp slip test
c)	Magnetic power loss test (if applicable)
d)	Tension – Compression test
e)	Corona extinction voltage test (dry)
f)	Radio interference voltage test (dry)
2.03.05	Flexible Copper Bond.
a)	Slip strength test - As per specification enclosed
2.03.06	Vibration Damper for Conductor and Earthwire.
a)	Dynamic characteristics test - As per specification enclosed
b)	Vibration Analysis - As per specification enclosed
c)	Clamp Slip Test - As per specification enclosed
d)	Fatigue Test - As per specification enclosed
e)	Chemical Analysis of Material
2.03.07	Earthwire Suspension clamp Assembly
a)	Mechanical strength Test - As per specification enclosed
b)	Clamp Slip Strength vs Torque test for suspension assembly - As per specification enclosed.
2.03.08	Earthwire Tension Clamp Assembly
a)	Mechanical strength test (excluding Clamp) - As per specification enclosed
b)	Slip strength test on tension assembly - As per specification enclosed
c)	Electrical resistance test on tension Clamp - As per specification enclosed
2.04.00	Hardware Fittings
2.04.01	On the complete insulator string with hardware fittings
a)	Power Frequency Voltage withstand test under wet condition - As per IS:731-1971
b)	Impulse voltage withstand test under dry condition - As per IEC:383-1970.
c)	Switching surge voltage withstand test under wet condition – As per IEC:383.

d)	Impulse voltage Flashover test under dry condition - As per IEC:383-1970.
e)	Voltage distribution test- As per specification enclosed
f)	Mechanical strength test for complete string - As per specification enclosed
g)	Vibration test- As per specification enclosed
	Notes: 1 All the type tests given above shall be conducted on single suspension and double tension insulator strings alongwith hardware fittings. 2. The mechanical strength test given above shall also be conducted on balance insulator strings alongwith hardware fittings.
2.04.02	On suspension hardware fittings only
a)	Magnetic power loss test for suspension assembly - As per specification enclosed
b)	Clamp slip strength for clamp - As per specification enclosed
c)	Ozone test on Elastomer – As per specification enclosed
2.04.03	On Tension Hardware Fittings only (As per IS : 2486 -Part-I)
a)	Electrical Resistance Test for dead end assembly
b)	Heating Cycle Test for dead end assembly
c)	Slip Strength Test for dead end assembly
2.05.00	On disc insulators
a)	Verification of dimension – As per IS:731-1971
b)	Thermal mechanical performance tests - As per IEC 575
c)	Power frequency voltage withstand and Flashover test (wet) - As per IS:731-1971,
d)	Impulse voltage withstand and flashover test (dry) - As per IS:731-1971
e)	Visible discharge test (dry) - As per IS:731
f)	RIV test (dry) - As per IS:8263-1976
3.00.00	ACCEPTANCE TESTS
3.01.00	Earthwire
a)	Visual check on drum - As per specification enclosed
b)	Visual check for joint etc. - As per specification enclosed
c)	Dimensional check - As per specification enclosed
d)	Galvanising test - As per specification enclosed
e)	Lay length check - As per specification enclosed
f)	Torsion test - As per specification enclosed
g)	Elongation test - As per IS:398 (Part-II)
h)	Wrap test - As per IS:398 (Part-II)
i)	DC resistance test - As per IS:398 (Part-II)
j)	Breaking load test - As per IS:398 (Part-II)
k)	Chemical analysis of steel - As per IS:398 (Part-II)
3.02.00	Conductor
a)	Visual and dimensional check on drum - As per specification enclosed

b)	Visual check for joint scratches and length of conductor - As per specification enclosed
c)	Dimensional check on individual strands - As per specification enclosed
d)	Check for lay-rations of various layers - As per specification enclosed
e)	Breaking load test on individual strands - As per IS:398 (Part IV)
f)	Wrap test on aluminium strands - As per IS:398 (Part-IV)
g)	DC resistance test on individual strands - As per IS:398 (Part IV)
h)	Elongation test - As per IS:398 (Part IV)
i)	Breaking load test on welded Aluminium strand - As per specification enclosed
	Note: All the above tests shall be carried out on aluminium strands after stranding only.
3.03.00	Conductor and Earthwire Accessories
3.03.01	Mid Span Compression Joint for Conductor and Earthwire
a)	Visual examination & dimensional verification - IS:2121 (Part-II)
b)	Galvanising Test - As per IS : 2121 (Part-II)
c)	Hardness Test - As per specification enclosed
3.03.02	Repair Sleeve for conductor
a)	Visual examination and dimensional verification – As per IS:2121 (Part-II)
3.03.03	Vibration Damper for Conductor and Earthwire.
a)	Visual examination and dimensional verification – As per IS:2121 (Part-II)
b)	Galvanising Test on - As per IS:2121 (Part-II) i) Damper mass ii) Messenger Cable
c)	Verification of Resonance Frequencies - As per specification enclosed
d)	Clamp Slip vs torque Test - As per specification enclosed
e)	Clamp Bolt Torque Test - As per specification enclosed
f)	Strength of the Messenger Cable - As per specification enclosed
g)	Mass Pull Off Test - As per specification enclosed
3.03.04	Spacer for Conductor/Spacer for jumper
a)	Visual examination and dimensional verification - As per IS : 2121 (Part-II)
b)	Galvanising test
c)	Movement test (except for spacers for jumpers)
d)	Clamp slip test
e)	Clamp bolt torque test
f)	Compressive and tensile test
g)	Assembly torque test
h)	Hardness test for elastomer (if applicable)
3.03.05	Earth wire Suspension Clamp Assembly
a)	Visual examination and dimensional verification – As per IS : 2121 (Part-II)
b)	Galvanising test - As per IS:2121 (Part-II)

c)	Clamp slip strength Vs Torque test - As per specification enclosed
d)	Mechanical strength of each component.
3.03.06	Earth wire Tension Clamp Assembly
a)	Visual examination and dimensional verification - As per IS : 2121 (Part-II)
b)	Galvanising test (excluding clamp) - As per IS : 2121 (Part-II)
c)	Hardness test - As per specification enclosed
d)	Mechanical strength test on each component (excluding clamp)
e)	Slip strength test on tension clamp - As per specification enclosed
3.04.00	Hardware Fittings
3.04.01	On both suspension and tension hardware fittings
a)	Visual Examination - As per IS : 2486 - (Part-I) - 1971
b)	Verification of dimension - As per IS : 2486 - (Part-I) - 1971
c)	Galvansing/Electroplating - As per specification enclosed
d)	Mechanical strength test of welded joint - As per specification enclosed
e)	Mechanical strength test of each component - As per specification enclosed
f)	Test on locking devices for ball and socket coupling – As per IEC:372(2)-1976
g)	Chemical analysis, hardness test, grain size, inclusion rating and magnetic particle inspection for forging /casting- As i)per specification enclosed
3.04.02	On suspension Hardware fittings only
a)	Clamp slip strength vs Torque test for suspension clamp - As per specn. enclosed
b)	Shore hardness test of elastomer cushion for AG suspension clamp
c)	Bend test for armour rod set - As per IS:2121-(Part-I)1981
d)	Resilience test for armour rods set - As per IS:2121
e)	Conductivity test for armour rods set. - As per IS:2121
3.04.03	On Tension Hardware Fittings only
a)	Slip strength test for dead end assembly : As per IS:2486-(Part-I)1971
3.05.00	Disc insulator
a)	Visual Examination - As per IS:731-1971
b)	Verification of dimensions - As per IS:731-1971
c)	Temperature cycle test - As per IS:731-1971
d)	Galvanising test - As per IS:731-1971
e)	Mechanical performance test – As per IEC:575-1977
f)	Tests on locking device for ball and socket coupling – As per IEC:372(2) -1976
g)	Eccentricity test - As per specification enclosed
h)	Electro-mechanical failing load - As per IEC:383-1993
i)	Puncture test - As per IS:731-1971
j)	Porosity test - As per IS:731-1971
4.00.00	**ROUTINE TESTS**
4.01.00	Earthwire

a)	Check that there are no cuts, fins etc. on the strands
b)	Check for correctness of stranding.
c)	Check that drums are as per specification.
4.02.00	Conductor
a)	Check to ensure that the joints are assembly per specification
b)	Check that there are no cuts, fins etc. on the strands
c)	Check that drums are as per specification.
d)	All acceptance test as mentioned in clause 3.02.00 above to be carried out on each coil.
4.03.00	Conductor and Earthwire Accessories
a)	Visual Examination and Dimensional Verification - As per IS : 2121 - (Part-II) - 1981
4.04.00	Hardware Fittings
a)	Visual Examination – As per IS:2486 (Part-I) 1971
b)	Proof Load Test - As per specification enclosed
4.05.00	Insulators
a)	Visual inspection - As per IS:731-1971
b)	Mechanical routine test - As per IS:731-1971
c)	Electrical routine test - As per IS:731-1971
5.00.00	TESTS DURING MANUFACTURE
5.01.00	Earthwire
a)	Chemical analysis of zinc used for galvanising – As per specification enclosed
b)	Chemical analysis of steel
5.02.00	Conductor
a)	Chemical analysis of aluminium used for making strands – As per specification enclosed
5.03.00	Conductor and Earthwire Accessories
a)	Chemical analysis of zinc used for galvanising : Samples taken from the zinc ingots shall be chemically analysed as per IS:209-1966
b)	Tests on Malleable Castings, Forgings and Fabricated Hardware. The Chemical analysis, mechanical and metallographic tests, inclusion rating and magnetic particle inspection for malleable castings, chemical analysis, hardness test, grain size and magnetic particle inspection for forgings and chemical analysis and mechanical tests for fabricated hardware will be based on heat number and heat treatment batch. The details regarding these tests will be as discussed and mutually agreed to by the Contractor and Owner in the quality assurance programme.
5.04.00	Hardware Fittings (on all components as applicable)
a)	Chemical analysis of zinc used for galvanising – As per specification enclosed
b)	Chemical analysis, hardware tests, grain size, inclusion rating and magnetic particle inspection for forgings/castings
c)	Chemical analysis and proof load test for fabricated hardware - As per specification enclosed

5.05.00	Insulators (on all components as applicable)
a)	Chemical analysis of zinc used for galvanising - As per specification enclosed
b)	Chemical analysis, mechanical and metallographic test and magnetic particle inspection for malleable/castings - As per specification enclosed
c)	Chemical analysis hardness tests and magnetic particle inspection for forgings - As per specification enclosed
d)	Hydraulic internal pressure tests on shell - As per specification enclosed
e)	Verification of dimensions – As per IS:731-1971
6.00.00	**TESTING EXPENSES**
6.01.00	Bidder shall indicate the schedule for all type tests if required to be conducted under this contract as per clause 2.00.00. Bidder shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that the tests can be completed within the time schedule guaranteed by them. The Contractor shall intimate the Owner about carrying out of the type tests alongwith detailed testing program at least 3 weeks in advance (in case of Indian Contractor and at least 6 weeks advance in case of foreign Contractor) of the schedule date of testing during which the Owner will arrange to depute his representative to be present at the time of carrying out the tests.
6.02.00	The entire cost of testing for acceptance and routine tests and tests during manufacturer specified herein shall be treated as included in the quoted unit price [redacted] except for the expenses of the Inspector/Owner's representative.
7.00.00	**SAMPLE BATCH FOR TYPE TESTING**
	The Contractor shall offer at least three times the quantity of material required for conducting all the type tests for sample selection. Before sample selection, the Contractor shall be required to conduct all the acceptance tests successfully in presented of Owner representative.
8.00.00	**ADDITIONAL TESTS**
8.01.00	Owner reserves the right of having at his own expensed any other tests of reasonable nature carried out at Contractor's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy that the material comply with the specifications.
8.02.00	Owner also reserves the right to conduct all the tests mentioned in this specification at this own expense on the samples drawn from the site at Contractor's premises or at any other test center. In case of any failure, it shall be binding on the part of Contractor to replace that particular lot completely without any extra cost to the Owner.
9.00.00	**TESTS REPORTS**
9.01.00	Copies of type test reports shall be furnished in at least six (6) copies. One copy will be returned, duly certified by the Owner, only after which the commercial production of the concerned material will start.
9.02.00	Copies of acceptance test reports shall be furnished in at least six (6) copies. One copy will be returned, duly certified by the Owner, only after which the material will be dispatched.

9.03.00	Records of routine test reports shall be maintained by the Contractor at his works for periodic inspection by the Owner's representative.
9.04.00	Test certificates of tests during manufacture as maintained by the Contractor, shall be produced for verification as and when desired by the Owner.
10.00.00	**INSPECTION**
10.01.00	The Owner's representative(s) shall at all times be entitled to have access to works and all places of manufacture, where materials and their components are being manufactured. The representatives shall have full facilities for unrestricted inspection of the Contractor's works, raw materials, manufacture of the material/item for conducting necessary tests as detailed herein.
10.02.00	The Contractor shall keep the Owner informed in advance of the time of starting and of the progress of manufacture of material / items in their various stages so that arrangement could be made for inspection.
10.03.00	No material/ item shall be dispatched from its point of manufacturer before it has been satisfactorily inspected and tested, unless the inspection is waived off by the Owner in writing. In the latter case also, the material/items shall be dispatched only after satisfactory testing for all tests specified herein have been completed.
10.04.00	The acceptance of any quantity of material /item shall in no way relieve the Contractor of his responsibility of meeting all the requirement of the specification, and shall not prevent subsequent rejection if such material / items are later found to be defective.

ANNEXURE - A

NORMS AND PROCEDURES OF TESTS

1.00.00 **TESTS ON EARTHWIRE**

1.01.00 UTS Test

Circles perpendicular to the axis of the earthwire shall be marked at two places on a sample of earthwire of minimum 5 m length suitably places compressed with dead end clamps at both ends. The load shall be increased at a steady rate upto 50 % of UTS and held for one minute. The circles drawing shall not be distorted due to relative movement of strands. These after the load shall be increased at a steady rate to 100 % of UTS and held for one minute. The earthwire sample shall not fail during this period. The applied load shall then be increased until the failing load is reached and value recorded.

1.02.00 DC Resistance Test

On an earthwire Sample of minimum 5 m length two contact clamps shall be fixed. The resistance shall be measured by a Kelvin double - bridge by placing the clamps initially zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to 20 ° C. The resistance corrected to 20 ° C shall confirm to the requirement of this specification.

1.03.00 Visual Check for joints

One drum from each lot shall be rewound in the presence of the inspector. The inspector shall visually check for scratches etc. and see that the earthwire generally conforms to the requirements of this specification.

1.04.00 Torsion Test

The numbe of twists which a single steel strand shall withstand during torsion test shall be at least eighteen for a length of 100 time the standard dia of that strand.

1.05.00 Visual check on Drums

The drums shall be visually checked to ensure that they conform to his specification.

1.06.00 Dimensional Check

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

1.07.00 Lay length Check

The lay length shall be checked to ensure that they conform to the requirements of this specification.

Clause No.	TECHNICAL REQUIREMENTS
1.08.00	Galvanising Test The test procedure shall be as specified in IS:4826-1968. The material shall conform to the requirements of this specification.
1.09.00	Chemical Analysis of Zinc used for Galvanising Samples taken from zinc ingots shall be chemically / spectrographically analysed. The same shall be in conformity to the relevant standards.
1.10.00	Chemical Analysis of Steel Sample taken from the steel ingots/coils/strands shall be chemically / spectrographically analysed. The same shall be in conformity to the relevant standards.
2.00.00	**TESTS ON CONDUCTOR**
2.01.00	UTS Test On Stranded Conductor Circles perpendicular to the axis of the conductor shall be marked at two places on a sample conductor of minimum 5 m length suitably compressed with dead end clamps at either end. The load shall be increased at a steady rate upto 50% of rated UTS and held for one minute. The circles drawing shall not be distorted due to the relative movement of strands. Thereafter the load shall be increased at a steady rate to 100% of the rated UTS for one minute. The conductor sample shall not fail during this period the applied load shall then be increased until the failing load is reached and the value recorded.
2.02.00	DC Resistance Test On Stranded Conductor On a conductor sample of minimum 5 m length two contact clamps shall be fixed. The resistance shall be measured by a Kevin double bridge by placing the clamps initially zero meter and subsequently one metre apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20 deg.C as per IS:398 (Part-IV)-1979. The resistance corrected at 20 deg. C shall conform to the requirements of this specification.
2.03.00	Chemical Analysis Of Aluminum Samples taken from the heat treated batch/coils/strands, shall be chemically/ spectrographically analysed. The same shall be in conformity to the requirements stated in this specification.
2.04.00	Visual And Dimensional Check On Drums The drums shall be visually and dimensionally checked to ensure that they conform to the requirements of this specification.
2.05.00	Visual Check For Joints, Scratches, etc.

Conductor drums shall be rewound in the presence of the inspector. The inspector shall visual check for scratches, joints etc. and that the conductor generally conform to the requirements of this specification.

2.06.00 Dimensional Check On Aluminium Strands

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

2.07.00 Check For Lay-Rations Of Various Layers

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

2.08.00 Elongations Test

The test procedure shall be as specified in IS-398 (Part-IV)-1979. The material shall conform to the requirements of this specification.

2.09.00 Breaking Load Test On Welded Aluminium Strand

The aluminium wires shall be welded and shall be subjected to tensile load. The welded point of the wire shall be able to withstand the minimum breaking load of the individual strand guaranteed by the bidder.

3.00.00 **CONDUCTOR AND EARTHWIRE ACCESSORIES**

3.01.00 Mid Span Compression Joint for Conductor and Earthwire

3.01.01 Slip Strength Test

The minimum free length between grips and the tests sample shall be three meters for conductor joint and one meter for earthwire joint. The test shall be carried out as per IS:2121-(Part-II) 1981 clause 6.4 except that the load shall be steadily increased to 95% of minimum ultimate tensile strength of conductor/ earthwire and retained for one minute at this load. There shall be no movement of the conductor/earthwire relative to the fittings during this one minute period and not failure of the fittings.

3.01.02 Hardness Test

The Brineel hardness at various points on the earthwire compression joint and tension clamp shall be measured.

3.02.00 **Flexible Copper Bond**

Slip Strength Test

On applying a load of 3 KN (300kg) between the two ends, stranded flexible copper cable shall not come out damaged. After the test, the lugs shall be cut open to ascertain that the gripping of cable has not been affected.

3.03.00 Vibration Damper for Conductor and Earthwire

3.03.01 Dynamic Characteristics Tests

a) The damper shall be mounted with its clamp tightened with torque recommended by the manufacturer on shaker table capable of simulating sinusoidal vibrations for frequencies ranging from 5 Hz to 40 Hz conductor and 10 to 60 Hz for earthwire.

b) The damper assembly shall be vibrated vertically with double amplitude of 1 mm at different frequencies to determine the following characteristics with the help of suitable record instruments:

i) Reactance Vs frequency.
ii) Phase angle Vs frequency.
iii) Power dissipation Vs frequency.

c) The above characteristics shall be determined by averaging the characteristics of the damper by carrying out this test three times on a single damper. This test shall be carried out on atleast five nos, of damper. The mean reactance and phase angle curves shall be drawn with the criteria of best fit method.

d) The reactance Vs frequency curve shall not show steep peaks at resonance frequencies and deep troughs between the resonance frequencies. The resonance frequencies shall be suitably spread within the aeolian vibration frequency band between the lower and upper dangerous frequency limits determined by the vibration analysis of conductor without dampers. The mean damper force response Vs frequency curve shall show a trend compatible with optimum force of the conductor acting on the sinusoidal half wavelength at unit displacement of antinode and it shall lie within the envelope of F1 and F2.

Where F1 = 2 fi and F2 = 0.5 fi
for vibration damper for conductor / earthwire

Where $fi = 2 \times 2 \pi f \sqrt{TM}$
T = tension of conductor
M = mass of conductor

e) F1 and F2 are forces in kg/mm and 'f' is the frequency in hertz. Similarly for mean phase angle Vs frequency curve the phase angles shall lie between 25 deg. and 135 deg. within the frequency range of interest.

3.03.02 Vibration Analysis
The vibration analysis of the conductor/earthwire shall be done with and without damper installed on the span. The vibration analysis shall be done on a digital computer using energy balance approach, the following parameters shall be taken into account for the propose of analysis:

a)	The analysis shall be done for single conductor / earthwire without armour rods as per the parameters given at relevant clauses of this specification. The tension shall be taken as 43 KN and 14 KN for conductor and earthwire respectively for a span ranging from 50 m to 600 m.
b)	The self damping factor and flexural stiffness (E1) for conductor shall be calculated on the basis of experimental results. The details of experimental analysis with the data should be furnished.
c)	The power dissipation curve obtained from dynamic characteristic. Test shall be used for analysis with damper.
d)	Examine the Aeolian vibration level of the conductor with and without vibration damper installed at the recommended location for wind velocity ranging from 0 to 30 Km. Per hour. Predicting amplitude, frequency and vibration energy input.
e)	From vibrations analysis of conductor / earthwire without damper, antinode vibration amplitude and dynamic strain levels at clamped span extremities as well as antinodes shall be examined and thus lower and upper dangerous frequency limits between the Aeolian vibration level exceeding the specified limits shall be determined.
f)	From vibrations analysis of conductor / earthwire without damper, antinode vibration amplitude and dynamic strain levels at clamped span extremities as well as antinodes shall be examined and thus lower and upper dangerous frequency limits between the Aeolian vibration level exceeding the specified limits shall be determined.
g)	The dynamic strain levels at damper attachment points, clamped span extremities and antinodes shall not exceed the specified limits. The damper clamp vibration amplitude shall not be more than that of the specified fatigue limits.
3.03.03	Clamp Slip and Fatigue Tests
a)	Test Set Up

The clamp slip and fatigue tests shall be conducted on a laboratory set up with a minimum span length of 30 m. The conductor / earthwire shall be tensioned at 43 KN/ 14 KN and shall not be equipped with protective armour rods at any point. Constant tension shall be maintained within the span by means of lever arm arrangement. After the conductor/earthwire has been tensioned, a clamp shall be installed to support the conductor/ earthwire at both ends and thus influence of connecting hardware fittings are eliminated from the free span. The clamps shall not be used for holding the tension on the conductor/ earthwire. There shall be no loose parts, such as suspension clamps, U bolts etc. on the test span supported between clamps mentioned above. The Span shall be equipped with vibrations inducing equipment suitable for producing steady standing vibration. The inducing equipment shall have facilities for stepless speed control as well as stepless amplitude arrangement. Equipment shall be available for measuring the frequency, cumulative number of cycles and the amplitude of vibration at any point along the span.

b) Clamp Slip Test

The vibration damper shall be installed on the test span. The damper clamp, after tightening with the manufacturer's specified tightening torque, when subjected to a longitudinal pull of 2.5 KN paralleled to the axis of conductor/ earthwire for a minimum duration of one minute shall not slip i.e. the permanent displacement between conductor/ earthwire and clamp measured after removal of the load shall not exceed 1.0 mm. The load shall be further increased till the clamp starts slipping. The load at which the clamp slips shall not be more than 5 KN.

c) Fatigue Test

The vibration damper shall be installed on the test span with the manufacturer's specified tightening torque. It shall be ensured that the damper shall be kept minimum three loops away from the shaker to eliminate stray signals influencing damper movement. The damper shall then be vibrated at the highest resonant frequency of each damper mass. For dampers involving torsional resonant frequencies tests shall be done at torsional modes also in addition to the highest resonant frequencies at vertical modes. The resonance frequency shall be identified as the frequency at which each damper mass vibrates with the maximum amplitude on itself. The amplitude of the damper clamp be maintained not less than $\pm$ 25 / f mm, where f is the frequency in Hz.

The test shall be conducted for minimum ten million cycles at each resonant frequency mentioned above. During the test if resonance shift is observed the test frequency shall be tuned to the new resonant frequency.

The clamp slip test as mentioned here in above shall be repeated after fatigue test without retorquing or adjusting the damper clamp and the clamp shall withstand a minimum load equal to 80% of the slip strength for a minimum duration of one minute.

After the above tests, the damper shall be removed from conductor/ earthwire and subjected to dynamic characteristics test. There shall not be any major deterioration in the characteristic of the damper. The damper then shall be cut open and inspected. There shall not be any broken, loose, or damaged part. There shall not be significant deterioration or wear of the damper. The conductor/ earthwire under clamp shall be also be free from any damage.

For the purpose of acceptance, the following criteria shall be applied:

i) There shall not be any frequency shift by more than $\pm$ 2 H_Z for frequencies lower than 15 Hz and +/- 3 Hz for frequencies higher than 15 Hz.
ii) The percentage variation in reactance curve after fatigue test shall lie within the limit which is to be guaranteed by the manufacturer.
iii) The reduction in power dissipation characteristic after the fatigue test shall not be more than the value guaranteed by the manufacturer. However, in no case the minimum power dissipation shall be less than governed by the lower limits of the reactance and phase angle curves as indicated in clause 3 (a) above.
iv) The deterioration of characteristics in respect of reactance and power dissipation shall be compared with respect to guaranteed value.

3.03.04	Verification of Resonance Frequencies The damper shall be mounted on a shaker table and vibrated at damper clamp amplitude of +/- 0.5 mm to determine the resonance frequencies. The resonance shall be visually identified as the frequency at which damper mass vibrates with maximum amplitude on itself. The resonance frequency thus identified shall be compared with the guaranteed value.
3.03.05	Clamp Bolt Torque Test The clamp shall be attached to section of the conductor / earthwire. A torque of 150% of the manufacturers specified torque shall be applied to the bolt. There shall be no failure of component parts.
3.03.06	Strength of the Messenger Cable The messenger cable shall be fixed in a suitable tensile testing machine and the tensile load shall be gradually applied until yield point in reached. The load shall not be less than the value guaranteed by the Bidder.
3.03.07	Mass Pull Off Test Each mass shall be pulled off in turn by fixing the mass in one jaw and the clamp in the other of a suitable tensile testing machine. The longitudinal pull shall be applied gradually until the mass begins to pull out off the messenger cable. The pull off loads shall not be less than the value guaranteed by the Bidder (min 500 kg.)
3.04.00	Earthwire Suspension / Tension Clamp
3.04.01	Mechanical Strength test The suspension assembly / tension assembly (excluding tension clamp) shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. This load shall be held for five minutes and ten removed. After removal of the load, the components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to loosen the nuts initially. The components shall not show any visual deformation and it shall be possible to dis-assemble them by hand. Hand tools may be used to loosen the nuts initially. The assembly shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS is reached and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.
3.04.02	Clamp Slip Strength Vs Torque Test for Suspension assembly. The suspension assembly shall be vertically suspended by means of a flexible attachment. A suitable length of the G. S. Earthwire shall be fixed in the clamp. The clamp slip strength at various tightening

	torque shall be obtained by gradually applying the load at one end of the earthwire. The clamp slip strength Vs torques curve shall be drawn. The clamp slip strength at the recommended tightening torque shall be more than 12 KN but less than 17 KN.
3.04.03	Slip Strength Test of Tension Clamp Tension clamps shall be compressed on a 5 m length of earthwire on both ends. The assembly shall be mounted on a tensile testing machine and anchored in a manner similar to the arrangement to be used in service. A tensile load of 50% of the specified braking load of the earthwire shall be applied and the sample shall be marked in such a way that movement relative to the fitting can easily by detected. Without any subsequent adjustment of the fitting, the load shall be steadily increased to 95% of the specified breaking load and maintained for one minute. There shall be no movement of the earthwire relative to the fitting during this one minute period and no failure of the fitting also.
3.04.04	Resistance Test of Tension Clamp. The tension clamp and the jumper shall be compressed on two suitable lengths of earthwire. The electrical resistance shall be measured between points on earthwire near the clamp and near the jumper mouth keeping 25 mm clearance of the fitting and should not exceed 75% of the measured resistance of equivalent length of earthwire. The test shall be conducted with direct current. The current connections shall be at a distance not less than 50 times the diameter of earthwire from the fitting and shall be made so that effective contact is ensured with all those strands of the earthwire which would be taken into account in calculating its equivalent resistance. The test shall be repeated with the polarity reversed and the average of the two results considered assembly the measured value.
3.04.05	Hardness test. The Brineel hardness at various points on the steel portion of tension clamp shall be measured.
3.04.06	Magnetic Power Loss Test The sample shall be tested in a manner to simulate service conditions. A 50 Hz alternating current over the range of 400 Amps to 900 Amps shall be passed and the Wattmeter readings of the power loss with an without damper or sample for the different values of current shall be tabulated and plotted on a graph. The difference in the power loss with and without damper shall be limited to 1 watt for 600 Amps (rms). The losses shall be determined by averaging the figures obtained from at least four samples of vibration dampers.
3.04.07	Chemical Analysis Test for each components Chemical analysis of the material used for the manufacturer of items shall be conducted to check conformity of the same with technical specification and approved drawings.
3.05.00	Spacer for line & Rigid spacer

Clause No.	TECHNICAL REQUIREMENTS
3.05.01	Clamp slip Test The spacer assembly shall be installed on test span of twin ACSR 'MOOSE' conductor bundle string at a tension of 43 kN. In case of spacer for jumper, the clamp of sample shall be tightened with a specified tightening torque. One of the clamp of sample when subjected to a longitudinal pull of 2.5 kN parallel to the axis of conductor for a minimum duration of one minute shall not slip on the conductor i.e. the permanent displacement between the conductor and the clamp of sample measured after removal of the load, shall not exceed 1.0 mm. Similar test shall be performed on the other clamp of the same sample. Such clamp slip tests shall also be conducted after each of the vibration test mentioned in clause 3.03.02 (a). Each clamp shall withstand a minimum longitudinal load of 2 kN for a minimum duration of one minute after the vibration test without any adjustment of sample.
3.05.02	Vibration tests The test set up shall be as per Clause 3.03.03 of Annexure – A. The spacer assembly shall be clamped to conductor. During the vibration tests the axis of the clamp of sample be maintained parallel to its initial static position by applying a tension of 43 kN on the ACSR 'MOOSE' conductor. The spacer assembly shall be free to vibrate and shall not be retorqued or adjusted between the tests. All the vibration tests mentioned hereunder shall be conducted on the same sample on same test span. The samples shall withstand the vibration tests without slipping on the conductor, loosening, damage or failure of component parts. After each vibration test, clamp slip test shall be carried out as per the procedure given in clause 3.05.01.
i)	Longitudinal Vibration Test. The stationary conductor and the vibrating conductor/equivalent diameter of aluminum alloy tube shall be restrained by fixed clamps. The displacement of the vibrating conductor shall be 25 mm minimum on either side. The longitudinal movement shall be parallel to the conductor at frequency not less than 2 Hz for minimum one million cycles.
ii)	Vertical vibration Test The spacer/spacer damper shall be installed in middle of the test span and the frequency chosen so as to get an odd number of loops. The shaker shall be positioned at least two loops away from the test specimen to allow free movement of the conductor close to the test specimen. One conductor shall be connected to the shaker and vibrated to an amplitude such that $F^{1.8}$ Ymax > 1000 mm/sec. Where Ymax being the antinode displacement (mm) and f is the test frequency (Hz). The test frequency shall be greater than 24 Hz and the total number of cycles shall be more than 10 millions.
iii)	Sub-span Oscillation Test The test shall be conducted for oscillation in horizontal plane at frequency higher than 3 Hz for minimum one million cycles. The amplitude for oscillation shall be kept equipment to an amplitude of

150 mm for a full sub-span of 80m. Both the conductor shall be vibrated 180 deg. out of phase with the above minimum amplitude.

3.05.03 Ozone Test for Elastomer

This test shall be performed in accordance with astm d-1171 by ozone chamber exposure method (method b). The test duration shall be 500 hours and the ozone concentration 50 pphm. At the test completion, there shall be no visible crack under a 2x magnification.

3.05.04 Compressive and Tensile Test

The spacer assembly shall withstand ultimate compressive load of 15 kN and tensile load of 7.5 kN applied between sub conductor bundle and held for one minute without failure. Line distance between clamps shall be recorded during each of the compression and tension test. Measurement shall be recorded at (i) no load (ii) with load (iii) after release of load. The center line distance under load shall be within ± 100 mm of the nominal design spacing. After release of load it shall be possible to retain the clamps at their original position using only slight hand pressure. There shall be no deformation of damage to the spacer assembly which would impair its function of maintaining the nominal spacing.

4.00.00 **HARDWARE FITTINGS AND INSULATORS**

4.01.00 Voltage Distribution Test

The voltage across each insulator Unit shall be measured by sphere gap method. The result obtained shall be converted into percentage. The Voltage across any disc should not exceed 10 % of the total voltage applied on the string, in case of tension string and 9% in case of suspension string.

4.02.00 Mechanical Strength Test for Complete String

The complete insulator string alongwith its hardware fittings excluding arcing horn, and suspension assembly /dead end assembly shall be subjected to a load equal to 50% of the specified Minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. This load shall be held for five minutes and then removed. After removal of the load, the string component shall not show any visual deformation and it shall be possible to disassemble term by hand. Hand tools may be used to remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS in reached and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load in reached and the value recorded.

4.03.00 Vibration test

The suspension string shall be tested in suspension mode and tension string in tension mode and tension string in tension mode itself in a laboratory span of minimum 30 meters. In the case of suspension string a tension more than 600 Kg shall be applied with the help of turn buckle. The insulator string alongwith help of turn buckle. The insulator string alongwith hardware fittings shall be strung at a tension of 86 KN and shall be secured with clamps. Vibration dampers shall not be used. The conductor shall be vibrated at the resonant frequency (f) of the insulator string (more than 10 Hz)

	corresponding to two or more loops on the insulator string by the means of vibration inducing equipment. The peak displacement in 'mm' at the antinode point nearest to the string shall be measured and the same shall not be less than 900/ (f** 1.8), mm depending upon 'f' selected. The insulator string shall withstand a minimum of 10 million cycles. After the test is over, the disc insulator shall be examined for looseness of pins and cap or any crack in the cement. The hardware fittings shall be examined for fatigue failure, slip strength and mechanical strength test. The slip strength of suspension assembly shall be carried out without any adjustment/removal. The disc insulators shall be further subjected to the following acceptance tests assembly per relevant standards a) Temperature cycle test followed by mechanical performance test assembly per IEC:575 Clause 4.0 : 60% discs of be tested b) Puncture test : 40% discs of be tested
4.04.00	Chemical analysis of zinc used for galvanising Samples taken from the zinc ingot shall be chemically analysed assembly per IS:209-1979. The purity shall not be less than 99.95% and 99.7% for zinc used for galvanising and sleeve respectively.
4.05.00	Test for forgings The chemical analysis hardness tests and magnetic particle inspection for forgings, will be conducted as per the internationally recognised procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the contractor and Owner.
4.06.00	Tests on castings The chemical analysis, mechanical and metallographic tests and magnetic particle inspection for castings will be as per the internationally recognised procedures for these tests. The sampling will based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the contractor and Owner.
4.07.00	Hydraulic internal pressure tests on shells The test shall be carried out on 100% shells before assembly. The details regarding test will be as discussed and mutually agreed to by the contractor and Owner.
4.08.00	Thermal mechanical performance test The thermal mechanical performance test shall be performed in accordance with IEC-575, clause 3, with the following modifications: The applied mechanical load during this test shall be 70% of the rated electro-mechanical of mechanical value. The acceptance criteria shall be : a) X > R + 3S where X = Mean value of the individual electro-mechanical/

mechanical failing load.
R = Rated Electro-mechanical / mechanical failing load.
S = Standard deviation.

b) The minimum sample size shall be taken as 10.

c) The individual electro-mechanical/ mechanical failing load shall be at least equal to the rated value. Also electrical puncture shall not occur before the ultimate fracture.

4.09.00 Eccentricity Test :

The insulator shall be vertically on a fixture using dummy pin and socket. A vertical scale with horizontal slider shall be used for the axial run out. The pointer shall be positioned in contract with the bottom of the outermost petticoat of the disc. The disc insulators shall be rotated with reference to the fixture and the slider shall be allowed to more up and down on the scale but always maintaining contact with bottom of the outermost petticoat. After one full rotation of the disc, the maximum and minimum position the slider has reached can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

Similarly using a horizontal scale with a vertical slider the radial run out shall be measured. The slider shall be positioned in the scale so as to establish contact with the circumference of the insulator and disc insulator rotated on it's fixture always maintaining contact. After one full rotation the maximum and minimum position the slider has reached on the scale are found out. The difference between the above readings shall satisfy the guaranteed particulars for radial run out.

4.10.00 Magnetic power Loss Test for Suspension Assembly

Same as clause 3.04.06 above

4.11.00 Clamp slip strength Vs Torque Test and clamp slip for AG Suspension Clamp / envelope type suspension clamp.

The suspension clamp shall be vertically suspended by means of a flexible attachment. A suitable length of ACSR 'MOOSE' conductor shall be fixed in the clamp. The clamp slip strength at various tightening torque shall be obtained by gradually applying the load at one end of the conductor. The clamp slip strength vs torque curve shall be drawn. The above procedure is applicable only for free centre type suspension clamp. For AG suspension clamp only clamp slip strength after assembly shall be found out. The clamp slip strength at the recommended tightening torque shall be more than 11 KN but less than 16 KN.

4.12.00 Galvanising / Electroplating Test

The test shall be carried out as per clause no. 5.9 of IS:2496 (Part-I) - 1971 except that both uniformity of zinc coating and standard preece test shall be carried out and the results obtained shall satisfy the requirements of this specification.

4.13.00 Mechanical Strength Test for welded Joints

	The welded portion of the component shall be subjected to a load of 2000 kgs for one minute. Thereafter, it shall be subjected to dei penetration/Ultrasonic test. There shall not be any crack at the welded portion.
4.14.00	Mechanical strength test of each component Each Component shall be subjected to a its 50 % Minimum UTS load which shall be increased at a steady rate to 67 % of min. UTS. The load shall be held for 5 minute and then removed. The component shall then be again be loaded to 50 % of UTS and then load shall be increased at a steady rate till the specified UTS and held for one minute. No fracture should occur. The load shall then be increased until the failing load is reached and the value recorded.
4.15.00	Test For Forging, Casting and Fabricated Hardware The Chemical analysis, hardness test, grain size, inclusion rating and magnetic particle inspection for forging, casting and chemical analysis and proof load test for fabricated hardware shall be as per the internationally recognised procedure for these tests The sampling will be based on heat number and heat treatment batch. The details regarding tests will be as in the quality Assurance programme.
5.00.00	Corona Extinction Voltage Test (Dry) The sample when subjected to power frequency voltage shall have a corona extinction voltage of not less than 320 kV rms line to ground under dry condition for 400 kV line. There shall be no evidence of corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IS:731.
6.00.00	Radio Interference Voltage Test (Dry) Under the conditions as specified under (5.00.00) above, the sample shall have a radio interference voltage level below 1000 micro volts at one MHz when subjected to 50 Hz AC voltage of 305 kV rms line to ground for 400 kV under dry condition. The test procedure shall be in accordance with IS:8263.

SECTION-3

PROJECT DETAILS & GENERAL TECHNICAL REQUIREMENTS

3.0 GENERAL

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

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

3.1 PROJECT INFORMATION:

	Particular	Details	
a)	Customer	**Nabinagar Power Generating Company Pvt. Ltd. (NPGC)** (A joint venture of NTPC Ltd. and Bihar State Electricity Board)	
b)	Project Title	400/132 kV Switchyard including 400 kV & 33 kV Transmission Lines for Nabinagar Super Thermal Power Project (3X660 MW) at Nabinagar, Bihar and extension of two line bays at 4X250MW Nabinagar TPP	
c)	Location	**Nabinagar STPP** (i.) Place : Nabinagar (ii) District :Aurangabad (iii.) State :Bihar	**Nabinagar TPP (BRBCL)** (i.) Place : Nabinagar (ii) District :Aurangabad (iii.) State :Bihar
d)	Nearest Road Head	National Highway-2 (Approximately 25 kms from National highway)	
e)	Nearest Rail Head	Dehri-On-Sone (Approximately 30 kms from Railway Station)	
SITE CONDITIONS			
a)	Max. ambient air temp.	50°C	
b)	Min. ambient air temp.	0°C	
c)	Max. design ambient temp.	50°C	
d)	Design reference RH	100 %	
e)	Altitude	<500 MSL	
f)	Pollution Severity	High Pollution level (25mm/kV)	
g)	Seismic Zone	Zone-III	
WIND DATA			
a)	Basic Wind speed	47m/sec	
b)	The risk co-efficient (K1)	1.07	
c)	Category of terrain	Category-2	

d)	Maximum wind pressure on steel members	1500 N/m2

3.1.1 SYSTEM PARAMETERS:

Sl.No.	Parameters	**400 kV**	**132 kV**	**33 kV**
1	Highest system voltage	420 kVrms	145 kVrms	36 kVrms
2	Lightning Impulse voltage	±1425kVp	± 650kVp	± 170kVp
3	Switching impulse voltage	±1050kVp	--	--
4	Power frequency withstand for 1 min (rms)	630 kV(rms)	275 kV(rms)	70 kV(rms)
5	Max. fault level (1 sec.)	50 kA	31.5kA	25 kA
6	Minimum creepage distance	10500 mm	3625mm	900 mm

3.1.2 AUXILIARY POWER:

Sl.No.	Nominal Connection Voltage	Variations in Voltage	Frequency	Phase	Neutral
1	415V	±10%	50±5%	3	Solidly Earthed
2	240V	±10%	50±5%	4	Solidly Earthed

Combined variation of voltage and frequency shall be + 10%. Fault level of 415V system shall not be less than 20kA.

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

Voltage	Equipment/1st Level	2nd Level	3rd Level
132kV	4600mm	8500mm	12500mm
400kV (1½ Breaker)	8000mm	16000mm	--

3.2 INSTRUCTION TO BIDDERS:

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the bidders may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly,

the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section-Lighting System.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard 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 under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 STANDARDS

3.3.1 The Contractor is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956, and other local rules and regulations.

3.3.2 The equipment to be furnished under this specification shall conform to latest issue with all amendments of standards and/or codes specified under respective section heads. The standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to compliment each other. The Contractor shall also note that list of standards presented in this specified is not complete. Whenever necessary the list of standards shall be considered in conjunction with specific IS/IEC. When the specified requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

3.3.3 Other internationally accepted standards which ensure equivalent or better performance that that specified in the standards referred under section shall also be acceptable.

3.3.4 In case governing standards for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in additional information schedule alongwith English language version of standard of relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Employer's

approval.

3.3.5 The full names of the codes and standards mentioned in abbreviations under various equipment heads are as follows:

BS British Standards
IEC/CISPR International Electro-technical Commission
IS Bureau of Indian Standards
ISO International Organisation for Standards
NEMA National Electric Manufacturers Association

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (not applicable for this project) short circuit etc for the equipment.

The equipment shall also comply with the following:

a) All equipments shall be suitable for hot line washing.
b). To facilitate erection of equipment, all items to be assembled at site shall be "match marked"'.
c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.
d) All equipment shall be supplied with necessary interpole cabling, and its cost shall be included in the cost of equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

All drawings submitted by the supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no

deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the purchaser will cover only general conformance of the data to the specification and documents, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect substation layout.. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the purchaser shall not be considered by the contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

3.5.2 Approval Procedure

The following procedure for submission and review/approval of the drawings, data,reports, information, etc. shall be followed by Contractor:

a. All data/information furnished by Vendor in the form of drawings, documents, catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".

b. The 'Master drawings list' shall be submitted for review and approval of Employer before award of contract. The Contractor shall have to prepare and submit any other drawings and reference documents in addition to the drawings contained in the list, if so required during engineering stage as felt necessary by the Employer. Number of copies of the list for the distribution shall be as mutually agreed between Contractor and Employer.

c. All drawings (including those of subvendors') shall bear at the right hand bottom corner the 'title block' with all relevant information duly filled in. The format of title block shall approved by Engineer within thirty (30) days after the letter of award. The Contractor shall give this format to his subvendor along with his purchase order for subvendor's compliance. The size of title block basic format and its contents shall not be changed. All drawings shall be in English language. All dimensions shall be in metric units.

d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Contractor shall resubmit the drawings approved under Category II and III within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.)

g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

h. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

i. Contractor shall not make any changes in the portion of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawings identifying the changes (alongwith reasons for changes) for Employer's review and approval.

j. Approval of drawings will not in any way relieve the Contractor of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

k. The drawing approval progress report shall be submitted in at least three (3) copies within one (1) week from the last date of the every month.

3.5.3 Erection Drawings.

a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc. The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.

b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.5.4 Instruction Manual

a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least thirty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, operation and maintenance procedures, etc. separately for each component/equipment alongwith log record format. These instruction manuals shall be submitted in five (5) copies for approval.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall being corporated and the updated final instruction manuals shall be submitted .

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

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets, drawings and list of parts with procedures for ordering spares. Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedure to be carried out daily, weekly, monthly and at longer intervals to ensure trouble free operation. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or breakdown. A collection of the manufacturer'' standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.5.5 Final Submission of drawings and documents:

The Contractor shall furnish the following after approval of all drawings /documents and test reports:

a. List of drawings bearing the Employer's and Contractor's drawing number.
b. Ten (10) bound sets alongwith 4 CD-ROMs of all drawing.
c. All documents/designs in five (5) copies as noted above.
d. Contractor shall also furnish nine (9) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish four (4) sets of film reproducibles or CD-ROMs of all as-built drawings as decided by the Employer.
e. The Contractor shall also furnish eleven (11) copies of instruction manuals (after approval) for all the equipments.

3.5.6 TEST REPORTS

Five (5) copies of all test reports shall be supplied for approval before shipment of equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval seven bound copies of all type and routine test reports shall be submitted to Employer.

3.6 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.
The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.7 LIMIT OF CONTRACT

All the equipment, materials and services furnished by the manufacturer shall be complete in every respect with all mountings, fitting, fixtures and standard accessories normally provided with such equipment, and needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in technical specification and unless included in the list of exclusions. The

manufacturer shall supply at no extra cost to Employer any additional material/service not covered specifically but which are found to be required for fulfillment of the scope of work under specification.

3.8 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 favorable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On - off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance 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.

Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

Degree of Protection

The enclosure of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a) Installed out door: IP- 55
b) Installed indoor in air conditioned area: IP-31
c) Installed in covered area: IP-52
d) Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e) For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

3.9 RATING PLATES, NAME PLATES AND LABELS

3.9.1 The equipment nameplate should preferably be of stainless steel. In case of aluminium, it should be at least 2mm thick.. The inscription on the nameplate shall be engraved and no punching shall be accepted except for equipment serial number and year of manufacture. These nameplates shall be black with white engraved lettering.

3.9.2 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.9.3 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.9.4 Name plates of cubicles and panels may be made of non-rusting metal or 3 ply lamicoid.

3.9.5 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.10 GALVANISING :

3.10.1 The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.

3.10.2 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, smooth continuous and free from acidspots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor’s cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness ofzinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS:2633.

3.10.3 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area. The threads having extra deposit of zinc shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.11 PAINTING

The sheet steel to be painted shall be pretreated in tanks in accordance with IS:6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "class-C" as specified in IS:6005. The phosphated surfaces shall be rinsed and passivated prior to application of stoved lead oxide primer coating. After primer application, two coats of finishing synthetic enamel paint on panels shall be applied. Electrostatic paining shall also be acceptable. Finishing paint on outside of the panels shall be as required otherwise by the Employer. The inside of the panels shall be glossy white. Each coat of finishing shall be properly stoved. The paint thickness shall not be less than 50 microns. Finished parts shall be coated by peelable compound by spraying method to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.

3.12 QUALITY ASSURANCE PROGRAMME

3.12.1 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his subcontractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS- 14001.

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

i. His organisation structure for the management and implementation of the proposed quality assurance programme
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.

x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.
xv. System for maintenance of records, and
xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component.

3.12.2 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.12.2.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification.
This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.

3.12.2.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor"s/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

3.12.2.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities starting from receipt of materials/equipment at site.

3.12.2.4 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans alongwith Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.
These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in

writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer alongwith technical justification for approval and dispositioning.

3.12.2.5 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to predespatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of MDCC.

3.12.2.6 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

3.12.2.7 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. All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.

3.12.2.8 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.

3.12.2.9 Test results or qualification tests and specimen testing shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.

3.12.2.10 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipments/systems shall also be complied with.

3.12.2.11 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

3.12.2.12 No welding shall be carried out on cast iron components for repair.

3.12.2.13 Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

3.12.2.14 All non-destructive examination shall be performed in accordance with written procedures as per International Standards, The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment

used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

3.12.2.15 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc..

Such quality plans of the successful vendors shall be finalised with the Employer and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. Within three weeks of the release of the purchase orders/contracts for such bought out items/components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor.

3.12.2.16 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their subvendor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

3.12.2.17 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

3.12.2.18 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

3.12.2.19 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

3.12.2.20 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.12.2.21 Burn in and Elevated Temperature Test Requirement for Electronics Solid State Equipment

a. All solid state electronic systems/equipment shall be tested as a complete system/equipment with all devices connected for a minimum of 168 hours (7 Days) continuously under energized conditions prior to shipment from Manufacturing works, as per the following cycle.

b. Elevated Temperature Test Cycle
During the elevated temperature test which shall be for 48 hours of the total 168 hours of testing, the ambient temperature shall be maintained at 50 deg.C. The equipment shall be interconnected with devices which will cause it to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.
During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components/modules shall be monitored. The temperature rise inside the cubicle should not exceed 10 deg.C above the ambient temp. at 50 deg.C.

c. Burn in Test Cycle
The 48 hours elevated temperature test shall be followed by 120 hours of burn in test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.
During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.
In case the Contractor/ sub-contractor is having any alternate established procedure of eliminating infant mortile components, the detail procedures followed by the Contractor/ sub- contractor alongwith the statistical figures to validate the alternate procedure to be forwarded.
The Contractor/Sub-contractor shall carry out routine test on 100% item at contractor/sub -contractor's works. The quantum of check/test for routine & acceptance test by employer shall be generally as per criteria/sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check/test for routine / acceptance test shall be as agreed during detailed engineering stage.

3.12.3 QUALITY ASSURANCE DOCUMENTS

3.12.3.1 The Contractor shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identifed in respective quality plan with tick (_) mark within three weeks after despatch of the equipment.
Typical contents of Quality Assurance Document is as below:-

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Factory test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
iv) Type test report(wherever applicable).

v) Non-destructive examination results /reports including radiography interpretation reports.
Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
vi) Heat Treatment Certificate/Record (Time- temperature Chart)
vii) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure)Verification sketches, if used and methods used to verify that the inspection and testing points in the Quality Plan were performed satisfactorily
viii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
ix) Certificate of Conformance (COC) whever applicable.
x) MDCC

3.12.3.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and otheragreed manuals/ procedures, prior to commissioning of individual system.

3.12.3.3 Due to the large variety of equipment items, it is always possible to adapt the content of the quality document to better match the particularities of any equipment. This shall be done in agreement with the Supplier and the Inspector.
The Quality Document file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.Each quality document shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

3.12.3.4 Before shipping any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory.The Inspector shall stamp,the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
iii) If a decision is made to ship equipment, whereas all outstanding actions cannot be readily cleared for the release of the quality document by the time as per contract documents (or finalization of the applicable section of the quality document within one month as per corresponding shipment date).The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status (signed by the Supplier Representative) to the Inspector and notify of the committed date for the completion of all outstanding actions & submission.The Inspector shall stamp the quality document for applicable section when it is effectively completed.
The final quality document will be compiled and issued at the final assembly place of equipment before shipment.

3.12.4 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer not later than 1 month after the delivery date for the corresponding equipment . One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site .

For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 1 month after the date of the last delivery similarly as stated above

3.13 TYPE TESTING , INSPECTION, TESTING & INSPECTION CERTIFICATE

3.13.1 The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

3.13.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

3.13.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

3.13.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

3.13.5 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works.The completion of these tests, or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

3.13.6 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall

provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

3.13.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.

3.13.8 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 3.03.00, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

3.13.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, thecontractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.

3.14 PACKAGING & PROTECTION

3.14.1 Packing, Marking and shipping

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

a. The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage.

b. The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.

c. The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.

d. The Contractor shall be liable for any damage or loss resulting due to careless, improper, poor or insufficient packing and handling.

e. Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked “Spare Parts Only”. They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.

f. The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

3.14.2 Transportation

a. The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.

b. All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer's recommendations. Employer shall have the right to decide the items that should be air freighted and Employer's decision shall be binding on Contractor

3.14.3 Insurance

a. The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.

b. Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise shall not constitute groups for claims for extension in time or for extra payment.

3.14.4 Storage of Equipment

a. The Contractor shall provide and construct adequate storage sheds for proper storage of equipment. Sensitive equipments shall be stored indoors. All equipment during storage shall be protected against damage due to act of nature or accidents. The storage instructions of the equipment manufacturers shall be strictly adhered to.

b. The necessary transport packing shall be removed as soon as possible after receipt of equipment at the work site(s).

3.15 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.15.1 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetallic liner.

3.15.2 The material of clamps and connectors shall be Galvanised mild steel for connecting to shield wire.

3.15.3 Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

3.15.4 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

3.15.5 They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

3.15.6 Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

3.15.7 Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.

3.16 CONTROL CABINETS , JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT .

3.16.1 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.

3.16.2 They shall be of painted sheet steel or aluminium. The thickness of sheet steel shall be 2mm cold rolled or 2.5mm hot rolled. The thickness of aluminium shall be 3mm and shall provide rigidity. Top of the boxes shall be sloped towards rear of the box. The paint shall be of grey RAL 9002 on the outside and glossy white inside. However, the junction and switch boxes shall be of hot dip galvanised sheet steel of 1.6mm thickness.

3.16.3 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

3.16.4 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.

3.16.5 The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.

3.16.6 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.16.7 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.16.8 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.17 TERMINAL BLOCKS

3.17.1 They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

3.17.2 The terminal blocks shall be of 1100 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.17.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating
plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

3.17.4 The terminals shall be provided with marking tags for wiring identification.

3.17.5 Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:
All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. aluminium conductor
Circuits
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor
3.18.02 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.

3.18 Wiring

3.18.1 All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:
a) All circuits except CT circuits 2.5 sq.mm
b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).

3.18.2 All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

3.18.3 Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

3.18.4 All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

3.18.5 All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.

3.19 CABLE GLANDS AND LUGS

3.19.1 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and off tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.

3.19.2 The cable glands shall be tested as per BS:6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

3.19.3 Cables lugs shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). The cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.20 CONDUITS, PIPES AND ACCESSORIES

3.20.1 The Contractor 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, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.

3.20.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. The outer surface of the 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 galvanised. All rigid conduits/ pipes shall be of a reputed make.

3.20.3 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

3.21 MOTOR CONTROL CENTRE

3.21.1 The 415 Volt motor control centres (if provided separately) shall conform to the requirements for boxes/cabinets/kiosks. They shall be fixed type, shall be fully sectionalised and shall be equipped with load break switches. Motor feeders shall be provided with isolating switch fuse unit and Contractor with thermal overload relay and single phase protection. The motor Contractor shall have one normally open auxiliary contact for alarm purposes. The motor control circuit shall be independent from all other control circuits.

3.21.2 Isolating Switches

The incoming power supply isolating switch operation handle shall be interlocked

with the control cabinet door as to prevent opening of door when main switch is closed. Device for by passing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions.

3.21.3 Fuses

All fuses shall be of the HRC cartridge type, conforming to IS:2208 and suitable to mount on plugin type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live conductor. Insulated fuse pulling handle shall be supplied with each control cabinet.

3.22 MOTORS

3.22.01 Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards.

3.22.02 Enclosures

a) For motors to be installed outdoor, the motor enclosure shall have degree of protection IP:55. For motors to be installed indoor, i.e. inside a box, the motor enclosure shall be dust proof equivalent to IP:44.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting condensation or other causes from all pockets in the motor casing.
d) Motors weighing more than 25 kg shall be provided with eyebolts, lugs or other means or facility for lifting.

3.22.03 Operational Features :

a) Continuous motor ratings (name plate rating) shall be at least suitable for the driven equipment at design duty operating point of driven equipment that will arise in service.
b) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the given system.

3.22.04 Starting Requirements

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops.
b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
c) The locked rotor current shall not exceed six(6) times the rated full load current for all motors subject to tolerance given in IS:325.
d) Motors when started with driven equipment imposing full staring torque and supply voltage conditions specified shall be capable of withstanding at least two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for

three equally spread starts per hour under the above referred supply condition.

e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by a least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Contractor shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated. The speed switch shall be capable of withstanding 120% of the rated speed in either directions of rotation.

3.22.05 The maximum permissible temperature rise over the ambient temperature shall be within the limits specified in IS:325 (for 3 phase induction motors) after adjustment due to increased ambient temperature specified.

3.22.06 The double amplitude of motor vibration shall be within the limits specified in IS:729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

3.22.07 All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes.

3.23 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.

b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination

c) Heat run test on contacts

d) IR/HV test, etc.

3.24 LAMPS AND SOCKETS

3.24.1 Lamps:

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

3.24.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.24.3 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

3.24.4 Switches and Fuses:

Each control 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 switch-fuse 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.

All control switches shall be of rotary type. Toggle/piano switches shall not be accepted.

3.25 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS

3.25.1 Bushings shall be manufactured and tested in accordance with IS:2099 & IEC:137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS:2544 / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.25.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

3.25.3 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.25.4 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

3.25.5 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.25.6 Contractor shall make available data on all the essential features of design including the method of assembly of shells and metal parts, number of shells per insulator, the manner in which mechanical stresses are transmitted through shells to adjacent parts, provision for meeting expansion stresses, results of corona and thermal shock tests, recommended working strength and any special design or arrangement employed to increase life under service conditions.

3.25.7 Post type insulators shall consist of a porcelain part permanently secured in metal base to be mounted on supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand all shocks to which they may be subjected to during operation of the associated equipment.

3.25.8 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.25.9 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued; porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.25.10 Bushings, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests and acceptance test/ sample test in accordance with relevant standards.

3.25.11 Insulator shall also meet requirement of IEC - 815 as applicable, having alternate long & short sheds.

3.26 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

The corona (for 400kV only) and RIV tests shall confirm to the requirements as per **Annexure A** to this chapter. The seismic withstand test for 400kV shall conform to requirements as per **Annexure B** to this chapter.

3.27 Enclosures:

1. Annexure- A - CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST
2. Annexure- B - SEISMIC WITHSTAND TEST

Annexure – A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1.0 **General**

Unless otherwise stipulated, all equipment 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 measurement of radio interference voltage (RIV).

2.0 **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.

3.0 **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 – I. 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 result 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 measurement 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% for the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 420 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 recommendations 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 the voltage read by the noise meter.
4.0	**Test Methods for visible Corona** The purpose of this test is to determine the corona extinction voltage of the 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 %, the voltage level shall be raised till inception of corona or rated voltage whichever is lower. The voltage will then be decreased slowly until all visible corona disappears. The test 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 the 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 procedure 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 connectors so as to show corona on bushing, insulators and all parts of energized connectors. The photographs shall be framed such that test object essentially fills the frame with no cut off.
4.1	For recording purposes, modern devices using UV recording methods such as image intensifier may also be used.
4.2	The test shall be recorded on each photograph. Additional 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.
4.3	In addition to photographs of the test object preferably four photographs shall be taken of the complete test assembly showing relative positions of the test equipment and test object. Thes e 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.
4.4	The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.
4.5	However both tests shall be carried out with the same test set up and as little time duration between tests as possible. No modification or treatment of the sample between tests will be allowed. Simultaneous RIV and visible corona extinction voltage testing may be permitted at the discretion of the owner's engineer, if in his opinion it will not prejudice other test.
5.0	**Test Records:**
	In addition to the information previously mentioned and requirements specified as per CISPR or NEMA 107-1964 the following data shall be included in the test report-
a)	Background noise before and after the test
b)	Detailed procedure of application of test voltage
c)	Measurement of RIV levels expressed in microvolts 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 micro volt in each direction.
f)	Onset and extinction of visible corona for each of the four tests required shall be recorded.

Annexure – B

SEISMIC WITHSTAND TEST
(For 400kV Only)

The seismic withstand test on the complete equipment (except BPI) shall be carried out along with supporting structure.

The bidder shall arrange to transport the structure from his contractor's premises / owner's sites for purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the terminal pad of the equipment and at any other point as agreed by the owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the purchaser.

SECTION-3

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.
The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other respective sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

a)	Customer/ Purchaser/ Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd, Jaipur
b)	Consultant	Tata consulting Engineer Ltd, Bangalore
c)	Project Title	2X660MW Super –Critical Thermal Power Station, Stage –V, Unit 7 & 8 - 400kV Switchyard at Suratgarh
d)	Location	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan
e)	Altitude and longitude	Lattitude:29 deg. 10 min. N Longitude: 74 deg. 01 min. E
f)	Elevation above mean sea level	186 m(approximately)
g)	Transport Facilities	Suratgarh project is located 27 km from Suratgarh , 15 km from Suratgarh to Biradhwal on NH15, 12km in east from NH15.
h)	Postal Address	To follow
SITE CONDITIONS		
a)	Mean of daily maximum temperature	32.3 deg. C
b)	Mean of daily minimum temperature	19.6 deg. C
c)	Highest temperature recorded	50 deg. C
d)	Lowest temperature recorded	-2.8 deg. C
e)	Design ambient temperature for electrical equipment design	50 deg. C
f)	Relative humidity	Varies between 21 % and 81%
g)	Pollution Severity	Heavily Polluted
h)	Seismic zone	II
i)	Basic Wind speed	47 m/sec

j)	Annual mean wind speed	4km/hr
k)	Terrain category	2
l)	Annual average rain fall	312 mm

SYSTEM PARAMETERS

Nominal system voltage	**400 kV**	**11kV**
Highest system voltage	420 kV	12kV
Basic Impulse level(dry /wet)	1425kVP	75kVP
Power frequency withstand voltage	630kVrms	28kVrms
Switching Impulse withstand voltage	1050 kVP	NA
Rated short time current	50 kA for 3 sec	40 kA for 1 sec
Frequency	50 Hz	50 Hz
Creepage distance	31mm/kV	31mm/kV
System Earthing	Effectively Earthed	Effectively Earthed

AUXILIARY POWER SUPPLY

3 phase A.C power supply	415V ± 10%, 50 Hz, 3-phase 4 wire, solidly earthed with variation in frequency of ± 5%
1 phase A.C power supply	240V ± 10%, 50 Hz, 1-phase , 2 wire , AC supply with variation in frequency of ± 5%
D.C. power supply	220V ±15%, 2-wire ungrounded 48V ±10%, 2 wire system positively earthed

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

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type. The Bidder / Contractor shall furnish the reports of all the type tests carried out within last **five years from the date of opening of the tender** (i.e. 03.12.2012) as listed in relevant clauses in respective electrical specification and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/ similar components /equipment/systems to those offered / proposed to be supplied under this contract.

Type tests done in an independent government laboratory or in the presence of representative of

State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer/Purchaser, and reports shall be submitted for approval. No charges shall be paid under this contract. All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.2.3 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purpose for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and 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 and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be

accepted. Installation shall be constructed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances and instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.
The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him. All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare in the proposal, where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

3.3.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All the steel works shall be thoroughly cleaned of rust , scale , oil , grease, dirt and scarf by pickling , emulsion cleaning , etc. The sheet steel shall be phosphated /oven dried and then painted with two coats of zinc rich primer paints . After application of the primer, two coats of

finished synthetic enamel paint shall be applied. The colour of the finished coats inside shall be **glossy white** and exterior of the treated sheet steel shall be **shade 631 of IS 5 /RAL 7032** for all switchboard /MCC/distribution board , control panels etc.

Sufficient quantities of touch paint shall be furnished for application at site. All the indoor cubicles shall be the same as exterior surface and for other miscellaneous items, colour scheme will be approved by the purchaser.

3.5 PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.

All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

3.6 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the 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 interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS:2629 or any other

equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM. Average weight of zinc coating shall be **750gm/sq.m.**

3.9 PACKING

The following details are to be clearly indicated in the material forwarding documents:

a) Name and address of the consignee.
b) Purchase order number.
c) Name of supplier/s.
d) Description of equipment / material.
e) Net weight.
f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost. The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbol i.e. fragile, handle with care, use no Hooks etc.

3.10 HANDLING, STORING AND INSTALLATION

Contractor may engage manufacturer's Engineers to supervise if required for unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser. Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser’s information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the

same is handed over to the purchaser in an operating condition after commissioning.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

3.11 DEGREE OF PROTECTION

The enclosures of the Control Cabinets, Junction boxes and Marshalling boxes panels etc to be installed shall be provided with degree of protection as detailed here under:

a) Installed out door: IP-55

b) Installed indoor in air conditioned area: IP-42

c) Installed in covered area IP:52

d) For LT switchgear (AC & DC distribution Boards): IP-54

The degree of protection shall be in accordance with IS:13947, (Part-1)/IEC-947(Part-1). Type test report/or degree of protection test on each type of the box shall be submitted for approval.

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has 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 requirements.

All such nameplate instruction plates, rating plates shall be bilingual with Hindi inscription first followed by English. Alternately two separate plates one with Hindi and other with English inscriptions may be provided.

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads, for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

Control and instrument leads from the switchboards or from other equipment will be brought to terminal boxes or control cabinets in conduits. All Inter-phase and external connections to equipment or to control cubicles will be made through terminal blocks.

Terminal blocks shall be **650 V** grade and have continuous rating to carry the maximum expected current on the terminals. Those shall be of moulded piece complete with insulated barriers stud type terminals, washers, nuts and lock nuts. Screw clamp, overall insulated, insertion type, rail mounted terminals can be used in place of stud type terminals. But preferably the terminal blocks shall be **non-disconnecting stud type equivalent to Elmex type CATM4,** Phoenix cage clamp type of Wedge or equivalent. The Insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal block 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 terminal shall be that maximum contact area is achieved when a cable is terminated. The terminal shall have a locking characteristic to prevent cable from escaping from the terminal clamp unless it is done intentionally. The conducting part in contact with cable shall preferably be tinned or silver plated however Nickel plated copper or zinc plated steel shall also be acceptable. The terminal blocks shall be of extensible design. The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT circuits :	Minimum of 2 nos. of 2.5 sq.mm, copper flexible.
All CT circuits :	Minimum of 4 nos. of 2.5 sq.mm, copper flexible..

The arrangements shall be in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live. At least 20 % spare terminals shall be provided on each panel/cubicle/box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks

shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

All input and output terminals of each control cubicle shall be tested for surge withstand capability in accordance with the relevant IEC Publications, in both longitudinal and transverse modes. The supplier shall also provide all necessary filtering, surge protection, interface relays and any other measures necessary to achieve an impulse withstand level at the cable interfaces of the equipment.

3.15 CONTROL CABINETS, JUNCTION BOXES, TERMINALS BOXES AND MARSHALLING BOXES FOR OUTDOOR EQUIPMENTS

All types of boxes, cabinets etc. shall generally conform to and be tested in accordance with IS-5039, IS-8623 or IEC-439, as applicable and the clause given below.

Control cabinet, Junction boxes, Marshalling boxes & Terminal boxes shall be made of sheet steel . Sheet steel used shall be at least 2.0 mm thick cold rolled or 2.5 mm hot rolled . The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. Cabinet/boxes shall be free standing floor mounting type, wall mounting type or pedestal mounting type as per requirements.

Cabinet /boxes shall be provided with double hinged doors with padlocking arrangements. The distance between two hinges shall be adequate to ensure uniform sealing pressure against atmosphere. The quality of gaskets shall be such that it does not get damaged/cracked during the operation of the equipment.

All door, removable covers and plates shall be gasketed all around with suitably profiled **Neoprene gaskets**. The gasket shall be tested in accordance with approved quality plan. The quality of gasket shall be such that it does not get damaged /cracked during the years of the equipment or its major overhaul whichever is earlier. All gasketed surfaces shall be smooth, straight and reinforced if necessary to minimize distortion and to make a tight seal. Ventilating Louvers, if provided, shall have screen and filters. The screen shall be fine wire mesh made of brass.

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof 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. Suitable cable gland plate projecting atleast 150 mm above from 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. The gland shall project atleast 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.

3.16 SPACE HEATERS

The heater shall be suitable for continuous operation at 240 V AC supply voltage and shall be provided with on – off switch and fuse shall be provided for heater.

One or more adequately rated, thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heater shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heater to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and air and shall consist of coiled resistance wire centered in metal sheath and completely encased in a highly compacted powder of Magnesium Oxide or other material having equal heat conduction and electrical insulation properties, or they shall consist of a resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and air. Alternatively, they shall consist of resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in glaze the surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

3.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

The bidder shall submit a detailed list of drawings / documents along with the bid proposal which he intends to submit to the Employer after award of the contract.

The supplier shall necessarily submit all the drawings / documents unless any thing is waived.

All engineering data submitted by the Contractor after final process including review and approval by the Employer shall form part of the Contract Document and the entire works performed under this specification shall be performed in strict conformity, unless otherwise expressly requested by the Employer in Writing.

3.18.2 DRAWINGS

All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearances and spaces required for installation and interconnection between various portions of equipments and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, name of consultant, the unit designation, RRVUNL contract no. and the name of the Project .If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Employer if so required.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Employer. Approval of Contractor's drawing or work by the Employer shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

3.18.3 APPROVAL PROCEDURE

The scheduled dates for the submission of these as well as for, any data/information to be furnished by the Employer would be discussed and finalised at the time of award. The supplier shall also submit required no. of copies as mentioned in this specification of all drawings/design documents/test reports for approval by the Employer. The following schedule shall be followed generally for approval.

i.	Approval/comments/by employer on Initial submission	Within 3 weeks of receipt
ii.	Resubmission	Within 2 (two) weeks (whenever from date of comments required) Including both ways postal time.
iii.	Approval or comments	Within 2 weeks of receipt of resubmission
iv.	Furnishing of distribution copies	2 weeks from the date of last approval.

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to

be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

The title block of drawings shall contain the following information incorporated in all contract drawings. Please refer enclosed sheet for details of Title block.

3.18.4 **DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER**

1) Drawings
2) Guaranteed Technical Particulars
3) Type Test Reports
4) Manufacturing Quality Plan

3.18.5 **DOCUMENTATION SCHEDULE**

S. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE FOR APPROVAL	FINAL DOCUMENTATION	
			Prints	Prints	CDs
1	Drawings and Data Sheets	1	7	8	-
2	Drawings "As Built "	-	-	8	05
3	Type Test Reports	1	3	4	-
4	Erection Manuals	-	7	8	-
5	Operation and Maintenance Manuals	-	7	8	-
6	Manufacturing Quality Plan	1	7	8	-
7	Field Quality Plan	1	7	8	-
8	Inspection Test Reports	-	-	8	-

Soft copies of drawings at contract stage shall also be submitted in **PDF format**.

Drawings will also be submitted in CD in AUTOCAD package for all major items.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.

SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

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

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

3.1 PROJECT DETAILS

	Particular	**Details**
a)	Customer	NTPC Ltd.
b)	Engineer/Consultant/ Inspector	NTPC Ltd.
c)	Project Title	North Karanpura Super Thermal Power Project (3x660 MW) : 400/220kV Switchyard at NKSTPP end & 220kV Sub-station at Mine end
d)	Project Location	Place: Near Tandwa town District: Hazaribagh & Chatra State: Jharkhand
e)	Latitude & Longitude	**400/220kV S/s at NKSTPP:** North: 23°50’ to 23°52’ and East: 84°59’ to 85°2’ **220kV S/s at Chatti Bariatu & Kerandari-A mine:** North: 23°52’35” and East: 85°05’25”
f)	Nearest Railway Station	Khalari Railway Station Ranchi-Garhwa section of Eastern Railways
g)	Distance of project location from the Railway station	40 Km (approx.)
h)	Nearest Major Town	Hazaribagh city
i)	Distance of the town from the project site	50 Km.
j)	Nearest commercial airport	Ranchi
k)	Distance of airport from the project site	150 Km
	SITE CONDITIONS (for design purposes)	
a)	Design ambient temperature	50°C
b)	Maximum Relative humidity	95 %
c)	Height above mean sea level	Less than 1000 meters
d)	Pollution Severity	Heavily polluted (With Coal dust & Fly ash) and Highly Corrosive environment.
e)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3) 1987
f)	Basic Wind speed “Vb” at ten meters	39 m/ sec

	above the mean ground level.	
g)	Category of terrain	Cat –2
h)	Risk Coefficient "K1"	1.06

3.1.1 **SYSTEM PARAMETERS:**

Sl.No.	Parameters	400 kV	220 kV
1	Highest system voltage	420 kV rms	245 kVrms
2	Lightning Impulse voltage	±1425kVp	± 1050kVp
3	Switching impulse voltage	±1050kVp	-
4	Power frequency withstand for 1 min (rms)	630 kV(rms)	460 kV(rms)
5	Max. fault level (1 sec.)	50 kA	40kA
6	Minimum creepage distance	10500 mm	6125mm

3.1.2 **AUXILIARY POWER:**

Sl.No.	Nominal Connection Voltage	Variations in Voltage	Frequency	Phase	Neutral
1	415V	±10%	50 (+3% -5%)	3Phase , 4 Wire	Solidly Earthed
2	240V	±10%	50 (+3% -5%)	1 phase	Solidly Earthed

Combined variation of voltage and frequency shall be + 10%. Design fault level of 415V system shall be restricted to 50kA rms for 1 second.

The operational limits for variation of DC voltage are (+) 10% to (-) 15%.

3.1.3 The various minimum heights of the switchyard shall be as given below from plinth level:

Voltage	Equipment /1st Level	2nd Level	3rd Level	Peak
220kV	6000mm	12000mm	17000mm	8500mm
400kV	8000mm	16000mm	23000mm	8500mm

The minimum vertical distance from the bottom of the lowest porcelain part of the bushing, porcelain enclosures or support insulators to the bottom of the equipment structure, where it rests on the foundation pad shall be 2550mm.

The minimum height of intermediate gantry tower for 400kV wherever required shall be 25 m and the peak (s) shall be of 8.5 m.

3.1.4 The minimum clearances for 400kV & 220 kV switchyards shall be as given below:

	400kV	**220kV**
Phase to earth clearance	3500 mm	2100mm
Phase to phase clearance	4000 mm	2100mm
Section clearance	6500 mm	5000mm

3.2 INSTRUCTION TO BIDDERS:

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the bidders may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar

equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously. All deviations from the specification shall be clearly brought out in the respective schedule of deviations. Any discrepancy between the specification and the catalogues or the bid, if not clearly brought out in the schedule, will not be considered as valid deviation.

Except for lighting fixtures, wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood as establishing type, function and quality and not as limiting competition. For lighting fixtures, makes shall be as defined in Section-Lighting System.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard 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 under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

The supplier is required to follow local statutory regulations stipulated in the latest amended Electricity Supply Act 1948 and Indian Electricity Rules 1956 (latest), and other local rules and regulations.

The equipment to be furnished under this specification shall conform to latest issue with all amendments of standards and/ or codes specified under respective section heads. The standards mentioned in the specification are not mutually exclusive or complete in them, but intended to complement each other. The supplier shall also note that list of standards presented in this specification is not complete. Whenever necessary the list standards shall be considered in conjunction with specific IS/IEC. When the specified requirements stipulated in the specifications exceed or differ than those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards which ensure equivalent or better performance that specified in the standards referred under section shall also be acceptable.

In case governing standards for the equivalent for the equipment is different from IS/ IEC, the salient points of difference shall be clearly brought out in additional information schedule along with English language version of standard of relevant extract of the same. The equipment conforming to standards other than IS/ IEC shall be subject to Purchaser’s approval.

The full names of the codes and standards mentioned in abbreviations under various equipment heads are as follows:

BS British Standards
IEC/ CISPR International Electro-technical Commission

IS	Bureau of Indian Standards
ISO	International Organization for Standards
NEMA	National Electric Manufacturers Association

3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions. All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (not applicable for this project) short circuit etc for the equipment .

The equipment shall also comply with the following:

a) All equipments shall be suitable for hot line washing.
b) To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
c) Piping, if any, between equipment control cabinet or operating mechanism to marshalling box of the equipment shall bear proper identification to facilitate the connection at site.
d) All equipment shall be supplied with necessary inter-pole cabling, and its cost shall be included in the cost of equipment.

3.5 ENGINEERING DATA

3.5.1 Drawings

All drawings submitted by the supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Contractor (including those of sub-vendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

After the approval of the drawings, further work by the Contractor shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the purchaser will cover only general conformance of the data to the specification and documents, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect plan layout. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the purchaser shall not be considered by the contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Contractor's risk. The Contractor may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Contractor's drawing or work by the Purchaser shall not relieve the contractor of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the contractor after final process including review and approval by the purchaser shall form part of the contract document and the entire work performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the purchaser in writing.

3.5.2 Approval Procedure

The following procedure for submission and review/approval of the drawings, data,reports, information, etc. shall be followed by Contractor:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for NTPC's information/interface and/or review and approval are referred by the general term "drawings".

b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.

c. All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance.

d. Contractor shall submit all the drawings in five (5) copies for review of Employer. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

f. Contractor shall resubmit the drawings approved under Category II, III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.).

g. In case Contractor does not agree with any specific comment, he shall furnish the explanation for the same to Employer consideration. In all such cases Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

h. It is the responsibility of the Contractor to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay

arising out of submission and modification of drawings shall not alter the contract completion schedule.

i. Contractor shall not make any changes in the portion of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**

j. Approval of drawings will not in any way relieve the Contractor of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

3.5.3 Erection Drawings.

a. Contractor shall furnish erection drawings for the guidance or commencement of erection or the first shipment, whichever is earlier. These shall generally comprise of fabrication/assembly drawings, various component/part details drawing, assembly, clearance data requirements, etc. The drawings shall contain details of components/ equipment with identification number, match marks, bill of materials, assembly procedures etc.

b. For all major equipment apart from above details, assembly sequence and instructions with check-lists shall be furnished in the form of erection manuals.

3.5.4 Instruction Manual

a. The Contractor shall submit to the Employer preliminary instruction manuals for all the equipments for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least sixty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipments, the transportation, storage, installation, testing, operation and maintenance procedures, etc. separately for each component/equipment along with log record format. These instruction manuals shall be submitted in five (5) copies for approval.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall being corporate and the updated final instruction manuals shall be submitted.

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

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

e. The manuals shall include the following

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

b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

f. Where applicable, fault location charts shall be included to facilitate finding the cause of mal-operation or break down.

g. A collection of the manufacturer's standard leaflets will not accepted to be taken as a compliance of this clause. The manual shall be specifically compiled for the concerned project.

3.5.5 Final Submission of drawings and documents:

The Contractor shall furnish the following after approval of all drawings /documents and test reports:

a. List of drawings bearing the Employer's and Contractor's drawing number.
b. Two (2) bound sets alongwith 4 CD-ROMs of all drawing.
c. All documents/designs in two (2) copies as noted above.
d. Contractor shall also furnish six (6) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Contractor shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.
e. The Contractor shall also furnish four (4) copies of instruction/ operations & maintenance manuals (after approval) for all the equipments.

3.5.6 TEST REPORTS

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval six (6) bound copies of all type and routine test reports shall be submitted to Employer.

3.6 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the contractor shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Contractor.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.7 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 favorable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

SPACE HEATERS

The heaters shall be suitable for continuous operation at 230 V as supply voltage. On –off switch and fuse shall be provided.

One or more adequately rated thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the compartment and electrical connections shall be made sufficiently away from below the heaters to minimize deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature to prevent condensation.

The heaters shall be suitably designed to prevent any contact between the heater wire and the air and shall consist of coiled resistance wire centered in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air. Alternatively, they shall consist of a resistance wire mounted into a tubular ceramic body built into an envelope of stainless steel or the resistance wire is wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

FUNGI STATIC VARNISH

Besides the space heaters, special moisture and fungus resistance 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.

Ventilation opening

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

Degree of Protection

The enclosure of the Control Cabinets, Junction boxes and Marshalling Boxes, panels etc. to be installed shall provide degree of protection as detailed here under:

a. Installed outdoor: IP- 55
b. Installed indoor in air conditioned area: IP-31
c. Installed in covered area: IP-52
d. Installed indoor in non air-conditioned area where possibility of entry of water is limited: IP-41.
e. For LT Switchgear (AC & DC distribution Boards) : IP-52

The degree of protection shall be in accordance with IS: 13947 (Part –I) / IEC-947 (Part-I) / IS 12063/IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval.

PRESERVATIVE SHOP COATING

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.

Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.

Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.

3.8 RATING PLATES, NAME PLATES AND LABELS

3.8.1 Each equipment shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer’s name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.

3.8.2 Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back.

3.8.3 The rated current, extended current rating and rated thermal current shall be clearly indicated in the name plate in case of current transformer.

3.8.4 Rated voltage, voltage factor and intermediate voltage shall be clearly indicated on the nameplate in case of capacitor voltage transformer.

3.8.5 Each switch shall a clear inscription identifying its function. Switches shall also have a clear inscription of each position indication.

3.8.6 All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.

3.8.7 All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.

3.9 GALVANISING:

3.9.1 The galvanised surface shall consist of a continuous film adhering to the steel. The finished surface shall be clean and smooth, and shall be free from defects like dissolved patches, base, spot, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off, etc. The presence of any of these defects shall render the material liable to rejection.

3.9.2 All exposed ferrous parts shall be hot dip galvanised as per IS:2629 & IS:2633, Galvanising shall be uniform, smooth continuous and free from acid spots. Should the galvanising of the sample be found defective, the entire batch of steel shall have to be re-galvanised at Contractor's cost. The amount of zinc deposit shall be not less than 610 gms. per sq.m. of surface area and in addition, the thickness of zinc at any spot shall not be less than 85 microns. The Employer reserves the right to measure the thickness of zinc deposit by Elkometer or any other instrument acceptable to Employer and reject any component which shows thickness of zinc at any location less than 85 microns. The testing on the galvanised materials shall be carried out as per IS:2633.

3.9.3 The amount of zinc deposit over threaded portion of the bolts, nuts and screws shall not be less than 300 gms. per sq. meter of surface area. The amount of zinc deposit on washers shall not be less than 340 gms. per sq. meter of surface area. The threads having extra deposit of zinc shall be removed by die cutting after the completion of galvanising. The removal of extra zinc shall be carefully done so that threads shall have minimum deposits of zinc on them as specified.

3.10 PAINTING

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:
Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). However in case electrostatic process of painting is offered for any electrical equipment, minimum paint thickness of 50 microns shall be acceptable for finish coat. Paint shade shall be as per technical specification.

3.11 QUALITY ASSURANCE PROGRAMME

3.11.1 The Contractor shall adopt suitable quality assurance programme to ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his subcontractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS- 14001.

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

i. His organisation structure for the management and implementation of the proposed quality assurance programme
ii. Quality System Manual
iii. Design Control System
iv. Documentation Data Control System
v. Qualification data for Bidder's key Personnel.
vi. The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.
vii. System for shop manufacturing and site erection controls including process, fabrication and assembly.
viii. Control of non-conforming items and system for corrective actions and resolution of deviations.
ix. Inspection and test procedure both for manufacture and field activities.
x. Control of calibration and testing of measuring testing equipments.
xi. System for Quality Audits.
xii. System for identification and appraisal of inspection status.
xiii. System for authorising release of manufactured product to the Employer.
xiv. System for handling storage and delivery.

xv. System for maintenance of records, and

xvi. Furnishing quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per format enclosed as Annexure-I.

3.12 GENERAL REQUIREMENTS - QUALITY ASSURANCE

3.12.1 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award.

3.12.2 Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. floppy or E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

3.12.3 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control Organisation, during various stages of site activities starting from receipt of materials/equipment at site.

3.12.4 The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.

3.12.5 These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.

3.12.6 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of MDCC.

3.12.7 All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

3.12.8 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.

3.12.9 All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.

3.12.10 All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.

3.12.11 Test results or qualification tests and specimen testing shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorised representative.

3.12.12 For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipments/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding.

3.12.13 All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

3.12.14 No welding shall be carried out on cast iron components for repair.

3.12.15 Unless otherwise proven and specifically agreed with the Employer, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

3.12.16 All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 50mm shall be ultrasonically tested.

The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the subcontractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified subcontractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.

3.12.17 For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the subcontractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control

organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.

3.12.18 Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub vendor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.

3.12.19 The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractors and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipments conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

3.12.20 Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.

3.12.21 For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

3.12.22 Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.12.23 Environmental Stress Screening

All solid state electronic system / equipment / sub assembly shall be free from infant mortile components. For establishing the compliance to this requirement, the contractor / sub – contractor should meet the following.

1. The Contractor / Sub – contractor shall furnish the established procedure being followed for eliminating infant mortile components. The procedure followed by the Contractor / Sub – contractor should be substantiated along with the statistical figures to validate the procedure being followed. The necessary details as required under this clause shall be furnished at the stage of QP finalization.

Or

In case the Contractor / Sub – contractor do not have any established procedure to eliminate infant mortile components then two or 10% whichever is less, most densely populated Panels shall be tested for Elevated Temperature Cycle Test as per the following procedure.

Elevated Temperature Test Cycle

During the elevated temperature test which shall be for 48 hours, the ambient temperature shall be maintained at 50° C. The equipment shall be interconnected with devices and kept under energized conditions so as to repeatedly perform all operations it is expected to perform in actual service with load on various components being equal to those which will be experienced in actual service.

During the elevated temperature test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature at 50° C.

In case of any failure during the test cycle, the further course of action should be mutually discussed for demonstrating the intent of the above requirement.

Burn In Test Cycle

The test shall be conducted on all the panels fully assembled and wired including the panels having undergone the above mentioned elevated temperature test.

The period of Burn in Test Cycle shall be 120 hrs and process shall be similar to the elevated temperature test as above except that the temperature shall be reduced to the ambient temperature prevalent at that time.

During the above tests, the process I/O and other load on the system shall be simulated by simulated inputs and in the case of control systems, the process which is to be controlled shall also be simulated. Testing of individual components or modules shall not be acceptable.

During the Burn in Test the cubicle doors shall be closed (or shall be in the position same as they are supposed to be in the field) and inside temperature in the zone of highest heat dissipating components / modules shall be monitored. The temperature rise inside the cubicle should not exceed 10° C above the ambient temperature.

The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.

3.13 QUALITY ASSURANCE DOCUMENTS

The Contractor shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identified in respective quality plan with tick (√) mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD-Rom may be issued not later than three weeks.

3.13.1 Typical contents of Quality Assurance Document are as below:-

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

iv) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
v) Heat Treatment Certificate/Record (Time- temperature Chart)
vi) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).
vii) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points.
viii) Certificate of Conformance (COC) whoever applicable.
ix) MDCC

3.13.2 Similarly, the contractor shall be required to submit two hard copies and two sets on CD ROM of Quality Assurance Documents (in line with above) pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.

3.13.3 Before dispatch/ commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory. The Inspector shall stamp the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing finalizing the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
i) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.14 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer after the delivery date for the corresponding equipment. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.
For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 1 month after the date of the last delivery similarly as stated above.

3.15 INSPECTION, TESTING & INSPECTION CERTIFICATE

3.15.1 The word ‘Inspector’ shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

3.15.2 The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect

and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

3.15.3 The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

3.15.4 The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

3.15.5 When the factory tests have been completed at the Contractor's or subcontractor's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

3.15.6 In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

3.15.7 The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.

3.15.8 To facilitate advance planning of inspection in addition to giving inspection notice, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

3.15.9 All inspection, measuring and test equipments used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipments in the presence of Project Manager / Inspector.

3.16 PACKAGING & TRANSPORTATION

Items shall be packed & dispatched separately to respective sites i.e. to 400/220kV S/s at NKSTPP end & to 220kV S/s at Chatti Bariatu & Kerandari-A mine end.

3.16.1 Packing, Marking and shipping

The packing and shipping shall be carried out in accordance with the standard practice of Contractor and with the following additional requirements:

a) The equipment shall be prepared in such a manner as to protect the equipment from damage or deterioration during shipping or storage. The shipments can be exposed to heavy rains, hot sun, high humidity and sudden extreme changes of temperature. The equipment shall be packed and shipped so as to protect it from all such conditions and any other abnormal conditions, generally expected during shipping & storage.

b) The metallic containers, if any, shall be considered as the property of the Contractor and he will be allowed to remove them from site once the contents are unpacked, inspected, documented and placed in temporary storage or in final position.

c) The equipment shall be shipped in such a manner as to facilitate unloading, handling and storage enroute and at the site. The Contractor shall provide lifting lugs and special lifting devices for proper handling and erection.

d) The Contractor shall be liable for any damage or loss resulting due to careless, improper, poor or insufficient packing and handling.

e) Spare parts and spare equipment shall be packed separately in containers adequate for long term storage, plainly marked “Spare Parts Only”. They shall be crated individually or in kits to be used in one single renewal or overhaul operation. Other spare part kits shall not be disturbed when using one set or kit.

f) The Contractor shall at all times protect and preserve from damage, loss, corrosion and all other forms of damage, all parts of the works.

3.16.2 Transportation

a) The Contractor shall make a careful examination of access rail/roadways to the site in order to confirm the practical maximum transport weight and dimensions as well as a careful examination of the ports of disembarkation particularly with respect to the capacity of the cranes installed and access roads.

b) All instruments and computer/microprocessor based equipment imported into India from overseas for the purpose of this contract shall be air freighted to the nearest possible point and further by rail/road taking due precautions as per manufacturer’s recommendations. Employer shall have the right to decide the items that should be air freighted and Employer’s decision shall be binding on Contractor.

3.16.3 Insurance

a) The Contractor shall insure all shipments and works at his own expense for not less than the full replacement cost plus any additional cost for accelerated manufacturing of the replacement parts.

b) Loss or the damage to equipment during shipping or transportation to the site(s) or otherwise

shall not constitute groups for claims for extension in time or for extra payment.

3.17 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

3.17.1 The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS:617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 2mm thick bimetallic liner.

3.17.2 The material of clamps and connectors shall be Galvanised mild steel for connecting to shield wire.

3.17.3 Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

3.17.4 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

3.17.5 They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

3.17.6 Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

3.17.7 Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last atleast till erection time.

3.18 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS, AND DISC INSULATORS

3.18.1 Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5284. The support insulators shall be manufactured and tested as per IS: / IEC 168/IEC 273. The insulators shall also conform to IEC 815 as applicable.
Support insulators/ bushings/ hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

3.18.2 Porcelain used shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.

3.18.3 Glazing of the porcelain shall be uniform brown in colour, free form blisters, burns and other similar defects.

3.18.4 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or injury to conductors or when operating at normal rated voltage.

3.18.5 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall be lead to deterioration. All ferrous parts shall be hot dip galvanised.

3.18.6 Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps, the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

3.18.7 All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued, porcelain parts by grinding and metal parts by machining. Insulator/ bushing design shall be such as to ensure a uniform compressive pressure on the joints.

3.18.8 Insulator shall also meet requirement of IEC - 815 as applicable, having alternate long & short sheds.

3.19 CONTROL CABINETS, JUNCTION BOXES, TERMINAL BOXES & MARSHALLING BOXES FOR OUTDOOR EQUIPMENT.

3.19.1 All types of control cabinets, junction boxes, marshaling boxes, lighting panels, terminal boxes, operating mechanism boxes, Kiosks etc. shall generally conform to IS:5039, IS:8623 and IEC:439 as applicable.

3.19.2 **Mechanism Box/ Control Cabinet/ Kiosks:** A sheet steel (atleast 2.5 mm thick), dust and vermin proof M.Box/CCC/CMB shall be provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. One dummy terminal block in between each trip wire terminal shall be provided. At least 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber.

Painting of boxes shall be as follows,

- External surface : Chemical resistant epoxy zinc phosphate primer, MIO (Micaceious iron oxide) as intermediate paint followed by polyurethane finish paint **(RAL 5012 Blue)**
- Internal surface : Chemical resistant epoxy zinc phosphate primer followed by chemical & heat resistant **epoxy enamel white paint**.

3.19.3 **Junction Boxes:** The junction boxes shall be made of minimum 2 mm thick sheet steel. Gland plates shall be removable type and made of 3 mm thick sheet steel. The boxes shall be provided with detachable cover or hinged door with captive screws. Top of the box shall be arranged to slope towards the rear of the box. The box shall be **hot dip galvanised** and shall be provided with suitable neoprene gaskets to achieve requisite degree of protection. Adequate spacing shall be provided to terminate the external cables. The boxes shall be suitable for mounting on various types of steel structures. The terminal blocks provided shall be of 650 V grade, rated for 10 A for control cables. Suitable numbering for terminal blocks shall be done. In case of junction box for power cable, the box shall be rated for maximum current carrying capacity. Terminal blocks shall be of one piece, Klippon RSF-1 or ELMEX CSLT-1 type with insulating barriers.

3.19.4 The cabinets/boxes/kiosks/panels shall be free standing or wall mounting or pedestal mounting type. They shall have hinged doors with padlocking arrangement. All doors, removable covers and plates shall be gasketed all around with neoprene gaskets.

3.19.5 The degree of protection of of all the outdoor boxes shall not be less than IP 55 as per IS 2147.

3.19.6 The cable entry shall be from bottom, for which removable gasketed cable gland plates shall be provided.

3.19.7 Suitable 240V, single phase, 50Hz ac heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10deg. above the ambient.

3.19.8 The size of enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/kiosk/panel shall be provided with a 15A, 240V ac, 2 pole, 3 pin industrial grade receptacle with switch. For incoming supply, MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be of rotary switch type.

3.19.9 Each cabinet/box/kiosk/panel shall be provided with two earthing pads to receive 75mmx12mm GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire. The cabinets/boxes/kiosks/panels shall also be provided with danger plate, and internal wiring diagram pasted on inside of the door. The front label shall be on a 3mm thick plastic plate with white letters engraved on black background

3.20 TERMINAL BLOCKS

3.20.1 They shall be non-disconnecting stud type of extensible design equivalent to Elmex type CAT-M4.

3.20.2 The terminal blocks shall be of 650 V grade, and rated to continuously carry maximum expected current. The conducting part shall be tinned or silver plated.

3.20.3 They shall be of moulded, non-inflammable thermosetting plastic. The material shall not deteriorate with varied conditions of temperature and humidity. The terminal blocks shall be fully enclosed with removable covers of transparent, non deteriorating plastic material. Insulating barriers shall be provided between the terminal blocks so that the barriers do not hinder the wiring operation without removing the barriers.

3.20.4 The terminals shall be provided with marking tags for wiring identification.

3.20.5 Unless otherwise required (expected current rating) or specified, terminal blocks shall be suitable for connecting the following conductors on each side:
All CT & VT circuits - Min. four 2.5 sq.mm. copper flexible conductor
AC & DC power supply -Two 16 sq.mm. Aluminium conductor
Other control circuits - Min. two 2.5 sq.mm. copper flexible conductor.

3.20.6 The terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. CT secondary leads shall also be provided with short circuiting and earthing facilities.

3.21 Wiring

3.21.1 All wiring shall be carried out with 1100 V grade stranded copper wires. The minimum size of the stranded conductor used for internal wiring shall be as follows:
a) All circuits except CT circuits 2.5 sq.mm
b) CT circuits 4 sq. mm (minimum number of strands shall be 3 per conductor).

3.21.2 All internal wiring shall be securely supported, neatly arranged readily accessible and connected to equipment terminals and terminal blocks.

3.21.3 Wire terminations shall be made with solderless crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires

shall not fall off when the wires and shall not fall off when the wire is disconnected from terminal blocks.

3.21.4 All wires directly connected to trip circuit breaker shall be distinguished by the addition of a red coloured unlettered ferrule. Number 6 & 9 shall not be included for ferrules purposes.

3.21.5 All terminals including spare terminals of auxiliary equipment shall be wired upto terminal blocks. Each equipment shall have its own central control cabinet in which all contacts including spare contacts from all poles shall be wired out. Interpole cabling for all equipment's shall be carried out by the Contractor.

3.22 CABLE GLANDS AND LUGS

3.22.1 Cable glands shall be Double compression type, tinned/Nicked plated (coating thickness not less than 20 microns in case of tin and 10 to 15 microns in case of nickel) brass cable glands for all power and control cables. They shall provide dust and weather proof terminations. They shall comprise of heavy duty brass casting, machine finished and tinned to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and off tested quality. Required number of packing glands to close unused openings in gland plates shall also be provided.

3.22.2 The cable glands shall be tested as per BS:6121. The cable glands shall also be duly tested for dust proof and weather proof termination.

3.22.3 Cables lugs for power cables shall be tinned copper solder less crimping type conforming to IS:8309 and 8394 suitable for aluminum or copper conductor (as applicable). Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipmentsThe cable lugs shall suit the type of terminals provided. The cable lugs shall be of Dowell make or equivalent.

3.4 CONDUITS, PIPES AND ACCESSORIES

3.4.1 The bidder 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, bushing reduces, enlargers, wooden plugs, coupling caps, nipples, gland sealing fittings, pull boxes, etc.

3.4.2 Rigid conduits shall be flow-coat metal conduits of Nagarjuna Coated Tubes or equivalent make. The outer surface of the 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 galvanised. All rigid conduits/ pipes shall be of a reputed make.

3.4.3 Flexible conduits shall be heat-resistant lead coated steel, water-leak, fire and rust proof, and be of PLICA make or equivalent.

3.5 MOTOR CONTROL CENTRE

3.5.1 The 415 Volt motor control centres (if provided separately) shall conform to the requirements for boxes/cabinets/kiosks. They shall be fixed type, shall be fully sectionalised and shall be equipped with load break switches. Motor feeders shall be provided with isolating switch fuse unit and Contractor with thermal overload relay and single phase protection. The motor Contractor shall have one normally open auxiliary contact for alarm purposes. The motor control circuit shall be independent from all other control circuits.

3.5.2 Isolating Switches

The incoming power supply isolating switch operation handle shall be interlocked with the control cabinet door as to prevent opening of door when main switch is closed. Device for by passing the door interlock shall also be provided. Switch handle shall have provision for locking in both fully open and fully closed positions.

3.5.3 Fuses

All fuses shall be of the HRC cartridge type, conforming to IS: 2208 and suitable to mount on plug-in type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live conductor. Insulated fuse pulling handle shall be supplied with each control cabinet.

3.6 MOTORS

3.6.1 Motors shall be "Squirrel Cage" three phase induction motors of sufficient size capable of satisfactory operation for the application and duty as required for the driven equipment and shall conform to type tests and shall be subjected to routine tests as per applicable standards.

3.6.2 Enclosures

a) For motors to be installed outdoor, the motor enclosure shall have degree of protection IP: 55. For motors to be installed indoor, i.e. inside a box, the motor enclosure shall be dust proof equivalent to IP: 54.
b) Two independent earthing points shall be provided on opposite sides of the motor for bolted connection of earthing conductor.
c) Motors shall have drain plugs so located that they will drain water resulting condensation or other causes from all pockets in the motor casing.

3.6.3 Operational Features :

a) Continuous motor ratings (name plate rating) shall be at least suitable for the driven equipment at design duty operating point of driven equipment that will arise in service.
b) Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously in the given system.

3.6.4 Starting Requirements

a) All induction motors shall be suitable for full voltage direct on-line starting. These shall be capable of starting and accelerating to the rated speed alongwith the driven equipment without exceeding the acceptable winding temperature even when the supply voltage drops.
b) Motors shall be capable of withstanding the electrodynamic stresses and heating imposed if it is started at a voltage of 110% of the rated value.
c) The locked rotor current shall not exceed six(6) times the rated full load current for all motors subject to tolerance given in IS:325.
d) Motors when started with driven equipment imposing full staring torque and supply voltage conditions specified shall be capable of withstanding at least two successive starts from cold condition at room temperature and one start from hot condition without injurious heating of winding. The motors shall also be suitable for three equally spread starts per hour under the above referred supply condition.
e) The locked rotor withstand time under hot condition at 110% of rated voltage shall be more than starting time with the driven equipment of minimum permissible voltage by a least two seconds or 15% of the accelerating time whichever is greater. In case it is not possible to meet the above requirement, the Contractor shall offer centrifugal type speed switch mounted on the motor shaft which shall remain closed for speeds lower

than 20% and open for speeds above 20% of the rated. The speed switch shall be capable of withstanding 120% of the rated speed in either directions of rotation.

3.6.5 The maximum permissible temperature rise over the ambient temperature shall be within the limits specified in IS: 325 (for 3 phase induction motors) after adjustment due to increased ambient temperature specified.

3.6.6 The double amplitude of motor vibration shall be within the limits specified in IS:729. Vibration shall also be within the limits specified by the relevant standard for the driven equipment when measured at the motor bearings.

3.6.7 All the induction motors shall be capable of running at 80% of rated voltage for a period of 5 minutes.

3.7 AUXILIARY SWITCH

The auxiliary switch shall conform of following type tests:

a) Electrical endurance test - A minimum of 1000 operations for 2A. D.C. with a time constant greater than or equal to 20 milliseconds with a subsequent examination of mV drop/ visual defects/ temperature rise test.
b) Mechanical endurance test - A minimum of 5000 operations with a subsequent checking of contact pressure test/ visual examination
c) Heat run test on contacts
d) IR/HV test, etc.

3.8 LAMPS AND SOCKETS

3.8.1 Lamps:

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

3.8.2 Sockets

All sockets (convenience outlets) shall be suitable to accept both 5 Amp & 15 Amp pin round Standard Indian plugs. They shall be switched sockets with shutters.

3.8.3 Hand Lamp:

A 240 Volts, single Phase, 50 Hz AC plug point shall be provided in the interior of each cubicle with ON-OFF Switch for connection of hand lamps.

3.9 SWITCHES & FUSES:

Each control panel shall be provided with necessary arrangements for receiving, distributing, isolating and fusing of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with switch-fuse 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.

All control switches shall be of rotary type. Toggle/piano switches shall not be accepted.

3.10 TYPE, ROUTINE & ACCEPTANCE TESTS:

All equipments to be supplied shall be of type tested design. During contract stage, bidder shall submit for Owner's approval the reports of all the type tests listed in this specification and carried out within last ten years from the date **28.11.2013**. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the tests should have been either conducted at an independent laboratory or should have be witnessed by a client.

However if contractor is not able to submit report of the type tests conducted within ten years from the date **28.11.2013** or in the case of type test reports are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

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

3.11 CORONA AND RIV TESTS AND SEISMIC WITHSTAND TEST:

a) The corona (for 400kV only) and RIV tests shall confirm to the requirements as per Annexure A.
b) The seismic withstand test for 400kV shall conform to requirements as per Annexure B.

3.12 Enclosures:

1. ANNEXURE- A - CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST
2. ANNEXURE- B - SEISMIC WITHSTAND TEST
3. ANNEXURE- I – MQP (NTPC format)
4. ANNEXURE- II – QUALITY ASSURANCE FOR SWITCHYARD

Annexure – A

CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST

1.0 **General**

Unless otherwise stipulated, all equipment 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 measurement of radio interference voltage (RIV).

2.0 **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.

3.0 **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 – I. 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 result 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 measurement 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% for the specified RIV test voltage for all equipment unless otherwise specified. The specified RIV test voltage for 420 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 recommendations 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 the voltage read by the noise meter.

4.0 **Test Methods for visible Corona**

The purpose of this test is to determine the corona extinction voltage of the 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 %, the voltage level shall be raised till inception of corona or rated voltage whichever is lower. The voltage will then be decreased slowly until all visible corona disappears. The test 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 the visible corona (negative or positive polarity) disappears.

Annexure – B

SEISMIC WITHSTAND TEST

The seismic withstand test on the complete equipment (except BPI) shall be carried out along with supporting structure.

The bidder shall arrange to transport the structure from his contractor's premises / owner's sites for purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the terminal pad of the equipment and at any other point as agreed by the owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the purchaser.

ANNEXURE-I

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

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER
SIGNATURE	

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

FOR NTPC USE

DOC. NO.:		REV…… CAT…..
REVIEWED BY	APPROVED BY	APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1 **1/1** **ENGG. DIV./QA&I**

SWITCHYARD **SQE_20**

Attributes / Characteristics / Items/Components Sub Systems	Make, model, Type & Rating, Test Certificate	Routine & Acceptance Test as per IS / IEC	Functional requirements as per NTPC Specification
Circuit Breaker (IEC:62271-100)	Y	Y	Y
Interruptor & hollow insulator (IEC:233/ IS:5284)	Y	Y	Y
Isolator (IEC:62271-102)	Y	Y	Y
Current Transformer (IEC:60044/BS:3938/IS2705)	Y	Y	Y
Capacitor Voltage Tramsformer (IEC:186A / 358/IS3156/IEC60044)	Y	Y	Y
Bus Post Insualtor (IEC:168 / 815 / IS:2544)	Y	Y	Y
Disc,Pin & String Insualtor (IEC:383 / IS:731)	Y	Y	Y
Long Rod Insualtor (IEC:433)	Y	Y	Y
Surge Arrestor (IEC:99-4/IS:3070)	Y	Y	Y
Hardware fittings for Insulator (IS:2486 / BS:3288)	Y	Y	Y
Spacer Clamps & Connector (IS:10162 / 5561)	Y	Y	Y
Aluminium Tube (IS:5082 / 2673 / 2678)	Y	Y	Y
Wave Trap (IEC:353 / IS:8792 / 8793)	Y	Y	Y
Conductor (IS:398-P-II)(V)	Y	Y	Y
Galvanised Steel Structures (IS:2062/2629/4759/6745)	Y	Y	Y
Vibration Damper (IS:9708)	Y	Y	Y
Sag Compensating Spring DIN:2089/2096 IS:3195 / 7906	Y	Y	Y
Control & Relay Panel	Y	Y	Y
SF6 Gas filling & evacuating plant	Y	Y	Y
SF6 Gas Leak Detector	Y	Y	Y
Leakage Current Analyser	Y	Y	Y
Nitrogen Gas Filling Device	Y	Y	Y
Protection Relays	Y	Y	Y
Event Logger	Y	Y	Y
Operation Analyser	Y	Y	Y
Disturbance Recorder	Y	Y	Y
Tariff Metering System	Y	Y	Y
Synchronising Trolly	Y	Y	Y

Attributes / Characteristics / Items/Components Sub Systems	Make, Type Rating,and Model, Test Certificates	Routine & Acceptance Test as per relevant IS/IEC	Functional requirements as per NTPC Specification
Relay Test Kit	Y	Y	Y
LT Switchgear /LT Panels (IEC:947 / IS:13947)	Y	Y	Y
Battery IS:1652	Y	Y	Y
Lighting Panels	Y	Y	Y
Surge Monitor	Y	Y	Y

Notes : 1) This is an indicative list of test/checks. The manufacture is to furnish a detailed
Quality Plan indicating the practice and procedure along with relevant supporting
documents during QP finalisation for all items.
2) All major Bought Out Items will be subject to NTPC approval.

SECTION-4

GUARANTEED TECHNICAL PARTCULARS

DRS Form 1

DATA REQUIREMENTS SHEETS for

OPTICAL POWERLINE GROUND WIRE (OPGW):

Manufacturer: _____

Part #: _____

OPGW Cable Diameter : _____ mm

CABLE CONSTRUCTION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
1	Fibre Manufacturer Dual Window Single-Mode:		
2	No. of Fibres Dual Window Single-Mode:	each	
3	Buffer Type:		
4	Buffer Tube Diameter:	mm	
5	Buffer Tube material		
6	No. of Buffer Tubes:	each	
7	No. of Fibers per Tube:	each	
8	Identification/numbering of individual tubes:		
9	No. of empty tubes (If any):	each	
10	Filling material:		
11	Filling material	Yes/No	
12.	Strength member(s):		
13.	Binding yarn/ tape:		

14. Describe Central Core Design:

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for

OPTICAL POWERLINE GROUND WIRE (OPGW):

Seq	Parameter:	Unit:	Particulars:
15.	20% Aluminum Clad steel wire Diameter: Number:	 mm each	
16.	Aluminum alloy wires Diameter: Number:	 mm each	
17.	Aluminum tube inner diameter:	mm	
18.	Aluminum tube outside diameter:	mm	
19.	Cable Diameter: (nominal ± deviation)	mm	
20.	Cable cross-section area (Nominal):	mm^2	
21.	Cable cross-section area (Effective):	mm^2	
22.	Fully Compliant with IEEE P1138:	Yes/No	

Mechanical Properties of Cable

23.	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	
24.	Fibre strain margin:	%	
25.	Zero fibre strain up to load	kN	
26.	Weight:	kg/km	
27.	Crush strength:	kg/mm	
28.	Equivalent Modulus of elasticity:	KN/mm^2	

- Continued -

Signature

Name

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for

OPTICAL-POWERLINE GROUND WIRE (OPGW):

Seq	Parameter:	Unit:	Particulars:
29.	Minimum Bending Radius without microbending:	mm	
30.	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	
31.	Tensile proof test (Screening) level:	KN/mm^2	
32.	Maximum permissible tensile stress:	KN/mm^2	
33.	Permissible CTS. tensile stress:	KN/mm^2	
34.	Maximum sag at maximum temperature and design span with no wind:	mm	
35.	Everyday tension at 32°C, no wind:	% of UTS	
3 6.	Maximum tension at 32°C with full wind pressure of .....Kg/m^2 on full projected are, 400 meter span:	Kg	

Thermal Properties of Cable

37.	Coefficient of linear expansion:	per °C	
38.	Coefficient of expansion Cladding: Core:	 per °C per °C	
39.	Nominal operating temperature range:	°C	
40.	SC current transient peak temperature:	°C	
41.	Maximum allowable temperature for lightning strike:	°C	

- Continued -

Signature

Name

Designation

DRS Form 1 (Continued)

DATA REQUIREMENTS SHEETS for

OPTICAL POWERLINE GROUND WIRE (OPGW):

CABLE SPOOL and DRUM			
Seq	**Parameter:**	**Unit:**	**Particulars:**
42.	Available length per spool Maximum: Nominal:	m	
43.	Size of drum:	m	
44.	Weight of empty drum:	kg	
45.	Weight of drum with cable: spooled	kg	
46.	Will drum length scheduling be practiced to match transmission line span lengths?	Yes/No	

47. Describe Drum materials:

48. Describe cable end capping and protection against abrasion etc.:

Signature

Name

Designation

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DRS Form 1 (continued)

DATA REQUIREMENTS SHEETS for

OPTICAL POWERLINE GROUND WIRE (OPGW):

INSTALLATION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
49.	Splice Loss: Maximum: Average:	 dB dB	
50.	Operating Temperature Range:	°C	
51.	Rated Isoceraunic No.		
52.	Expected Cable Life:	Years	
53.	Installation rate per team:	km/day	
54.	No. of persons per team:	no.	
55.	Max. possible span for specified operating conditions:	m	
56.	Midspan sag at 0°C with no wind loading:	mm	
57.	Midspan sag at max temp. with no wind loading:	mm	
58.	Midspan sag at max temp. and wind loading	mm	
59.	Cable swing angles: Worst Case: Everyday:		
69	Describe Installation method(s):		

DRS Form 2

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE

OPTICAL PARAMETERS			
Seq	**Parameter:**	**Unit:**	**Particulars:**
1.	Fiber manufacturer(s)/Type:		
2.	Fiber production method:		
3.	Attenuation Coefficient@ 1310 nm: @ 1550 nm:	dB/km dB/km	
4.	Attenuation Variation with Wavelength (±25 nm):	dB/km	
5.	Attenuation at water peak:	dB/km	
6.	Point discontinuity @ 1310nm: @ 1550nm:	dB dB	
7.	Temperature dependence (induced attenuation):	dB	
8.	Nominal Mode Field Diameter @ 1310 nm: @ 1550 nm:	.µm	
9.	Mode Field Diameter Deviation @ 1310 nm: @ 1550 nm:	µm	
10.	Mode field non-circularity:	%	
11.	Chromatic Dispersion Coefficient @ 1310 (1288-1339) nm: @ 1310 (1271-1360) nm: @ 1550 nm:	ps/nm.km	
12.	Zero dispersion wavelength:	nm	
13.	Zero dispersion Slope:	ps/nm^2.km	
14.	Cut off wavelength:	nm	
15.	Refractive Index:		
16.	Refractive Index profile:		
17.	Cladding Design:		
18.	Numerical aperture:		

Signature

Name

Designation

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DRS Form 2 (Continued)

DATA REQUIREMENTS SHEETS for OPTICAL FIBRE

PHYSICAL PROPERTIES			
Seq	**Parameter:**	**Unit:**	**Particulars:**
19.	Bend Performance: (37.5 mm radius, 100 turns) @1310 nm & @ 1550 nm (16mm radius, 1 turn.) @1550 nm	dB dB	
20.	Core Diameter (nominal ± deviation):	µm	
21.	Core non-circularity:	%	
22.	Cladding Diameter (nominal ± deviation):	µm	
23.	Core- Clad concentricity Error:	µm	
24.	Cladding non-circularity:	%	
25.	Fibre cut-off wavelength	µm	
26.	Protective Coating type & material Primary: Secondary:		
27.	Protective Coating Diameter (nominal ± deviation):	µm	
28.	Protective Coating removal method:		
29.	Coating Concentricity	µm	
30.	Polarisation mode dispersion coefficient	ps/km^1/2	
31.	Proof test level	kpsi	
32.	Colour coding scheme compliant with EIA/TIA 598 or IEC 60304 or Bellcore GR-20.	Yes/No	
33.	Colouring material compliant with requirement of technical specs?	Yes/No	

Signature

Name

Designation

7/29

DRS Form 3-A

DATA REQUIREMENTS SHEETS for OPGW HARDWARE AND FITTINGS

Suspension Clamp Assembly:

Manufacturer: _____

Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
1.	Minimum vertical Strength	kN	
2.	Maximum Slip Strength	kN	
3.	Minimum Slip Strength	kN	
4.	Length (nominal)	mm	
5.	Weight (nominal)	kg	
6.	Total Drop (maximum) including shackles	mm	
7.	Tightening torque (nominal)	Nm	
8.	Details of Armour Rod Set		
	a) No. of rods per clamp		
	b) Direction of Lay		
	c) Overall length	mm	
	d) Diameter of each Rod	mm	
	e) Tolerances (i) Diameter of each rod (ii) Length of each rod	 ±% ±%	
	f) Material of manufacture		
	g) UTS of each Rod	kN	
	h) Weight	kg	
9.	Details of Protection Splice Set (Reinforcing Rods)		
	i) No. of rods per clamp		

Signature

Name

Designation

8/20

DRS Form 3-A

DATA REQUIREMENTS SHEETS for
OPGW HARDWARE AND FITTINGS

Suspension Clamp Assembly:

Manufacturer: _____

Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
	j) Direction of Lay		
	k) Overall length	mm	
	l) Diameter of each Rod	mm	
	m) Tolerances (i) Diameter of each rod (ii) Length of each	 ±% ±%	
	n) Material of manufacture		
	o) UTS of each Rod	kN	
	p) Weight	kg	

Signature

Name

Designation

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DRS Form 3-B

DATA REQUIREMENTS SHEETS for HARDWARE AND FITTINGS

Dead End Clamp Assembly:

Manufacturer: _____

Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
1.	Minimum Slip Load	kN	
2.	Length (nominal)		
	a) Reinforcing Rods	mm	
	b) Dead end	mm	
3.	Weight (nominal)		
	a) Reinforcing Rods	kg	
	b) Dead end	kg	
4.	Breaking strength (minimum)	kN	
5.	Wire Size		
	a) Reinforcing Rods	mm	
	b) Dead end	mm	

Signature

Name

Designation

DRS Form 3-C

DATA REQUIREMENTS SHEETS for OPGW HARDWARE AND FITTINGS

Vibration Damper:

Manufacturer: _____

Part #: _____

ITEM	DESCRIPTION	UNIT	PARTICULARS
1.	Total Weight	Kg	
2.	Weight of each Damper	Kg	
3.	Material of Damper Weight		
4.	Clamp Material		
5.	Clamp bolt tightening torque	Nm	
6.	Clamp bolt material		
7.	Messenger Cable Material		
8.	No. of Strands in Messenger Cable		
9.	Breaking Strength of Messenger Cable	kN	
10.	Resonance Frequencies (include tolerances also)		
	a) First Frequency	Hz	
	b) Second Frequency	Hz	
	c) Third Frequency	Hz	
	d) Forth Frequency	Hz	
11.	Minimum Slip Strength of Damper Clamp		
	a) Before Fatigue Test	kN	
	b) After fatigue Test	kN	
12.	Maximum Slip Strength of Damper Clamp		
	a) Before Fatigue Test	kN	
	b) After fatigue Test	kN	

Signature

Name

Designation

DRS Form 3-D

DATA REQUIREMENTS SHEETS for OPGW HARDWARES and FITTINGS

Down Lead Clamp /Fastening Clamp

Manufacturer: _____

Part #: _____

ITEM	DESCRIPTION	Unit:	Particulars:
1.	Material:		
2.	Suitable for OPGW (range):	mm	
3.	Tightening torques	Nm	
4.	Vertical load	kN	
5.	Filler details:		
(a)	Material		
(b)	diameter:	mm	
6.	Tower attachment arrangement		

Signature

Name

Designation

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DRS Form 4

DATA REQUIREMENTS SHEETS for
Splice Enclosure

Manufacturer: _____

Model # _____

Seq	Parameter:	Unit:	Particulars:
1.	Dimensions H * W * D:	cm	
2.	Weight:	Kg	
3.	Colour and Finish:		
4.	Cable Glanding & Fixing:		
5.	Construction materials & Gauge:		
6.	Locking arrangements:		
7.	Installation Clearances: Front Access: Rear Access: Top * Bottom * Sides:	cm	
8.	IP Protection	Class	
9.	Total number of optical couplings:	ea	
10.	Provision of pass through splicing:	Yes/No	
11.	Whether filled with suitable encapsulant	Yes/No	
12.	Method(s) for mounting with the tower:		

Optical Fibre Cable Accommodations

13.	Cable Glanding:		
14.	Maximum number of cables that can be accommodated:	each	
15.	Diameter(s) of cables that can be accommodated:		

16. Describe Cable entries :

Signature

Name

Designation

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DRS Form 4 (Continued)

DATA REQUIREMENTS SHEETS for
Splice Enclosure

Seq	Parameter:	Unit:	Particulars:
	Cable Termination Splice Accomodations:		
17.	Details of Splice Trays:		
	Dimension:		
	Material/Gauge:		
	Weight:	kg	
	Colour & Finish:		
	Method of mounting:		
18.	Maximum number of splice trays:	ea	
19.	Number of splices per tray:	ea	
20.	Provision of Splice organisors:		
21.	Excess length of fibre service loops		

Signature

Name

Designation

DRS Form 5

DATA REQUIREMENTS SHEETS for Fibre Optic Distribution Panel (FODP)

Manufacturer: _____

Model # _____

Seq	Parameter:	Unit:	Particulars:
1.	Dimensions H * W * D:	cm	
2.	Weight:	Kg	
3.	Colour and Finish:		
4.	Cable Glanding & Fixing:		
5.	Construction materials & Gauge:		
6.	Locking arrangements:		
7.	Installation Clearances: Front Access: Rear Access: Top * Bottom * Sides:	cm	
8.	IP Protection	Class	
9.	Total number of optical couplings:	ea	
10.	Provision of pass through splicing:	Yes/No	
11.	Whether filled with suitable encapsulate	Yes/No	
12.	Method(s) for mounting with the tower:		

Optical Fibre Cable Accommodations

13.	Cable Glanding:		
14.	Maximum number of cables that can be accommodated:	each	
15.	Diameter(s) of cables that can be accommodated:		

16. Describe Cable entries:

Signature

Name

Designation

Seq	Parameter:	Unit:	Particulars:
Cable Termination Splice Accomodations:			
17.	Details of Splice Trays:		
	Dimension:		
	Material/Gauge:		
	Weight:	kg	
	Colour & Finish:		
	Method of mounting:		
18.	Maximum number of splice trays:	ea	
19.	Number of splices per tray:	ea	
20.	Provision of Splice organisors:		
21.	Do splice trays require a separate enclosure? If so:	Yes/No	
	Manufacturer:		
	Dimensions H * W * D:	cm	
	Weight:	Kg	
	Colour and Finish:		
	Method(s) of Mounting:		
	Construction materials & Gauge:		
	Locking arrangements:		
	Installation Clearances Front Access: Rear Access: Top * Bottom * Sides:	m	
22.	Excess length of fibre service loops		

Signature

Name

Designation

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DRS Form 6

DATA REQUIREMENTS SHEETS for APPROACH CABLE

Manufacturer: _____

Part #: _____

CABLE CONSTRUCTION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
1.	Fibre Manufacturer Dual Window Single-Mode:		
2.	No. of Fibres Dual Window Single-Mode:	each	
3.	Buffer Type:		
4.	Buffer Tube Diameter:	mm	
5.	Buffer Tube material		
6.	No. of Buffer Tubes:	each	
7.	No. of Fibers per Tube:	each	
8.	Identification/numbering of individual tubes:		
9.	No. of empty tubes (If any):	each	
10.	Filling material:		
11.	Filling material compliant with para 2.1.2.6.1 of vol. IIA of technical specifications?	Yes/No	
12.	Strength member(s):		
13.	Binding yarn/ tape:		
14	Describe centre core design		

DRS Form 6 (Continued)

DATA REQUIREMENTS SHEETS for APPROACH CABLE

Manufacturer: _____

Part #: _____

Seq	Parameter:	Unit:	Particulars:
14.	Outside Jacket coating (if any)		
15.	Jacket thickness	mm	
16.	Jacket non-circularity	%	
17.	Cable Diameter: (nominal deviation)	mm	
18.	Cable cross-section area:	mm^2	
19.	Rip-cord provided?	Yes/No	
20.	Fully Compliant with IEC 60974-3:	Yes/No	

Mechanical Properties of Cable

21.	Max. breaking load/ Ultimate Tensile Strength (UTS):	kN	
22.	Fibre strain margin:	%	
23.	Zero fibre strain up to load	kN	
24.	Weight:	kg/km	
25.	Crush strength:	kg/mm	
26.	Equivalent Modulus of elasticity:	KN/mm^2	
27.	Minimum Bending Radius without microbending:	mm	
28.	Maximum Bending Radius: Short Term: Long Term (Continuous):	mm	
29.	Tensile proof test (Screening) level:	KN/mm^2	
30.	Maximum permissible tensile stress:	KN/mm^2	
31.	Permissible CTS. tensile stress:	KN/mm^2	

- Continued -

Signature

Name

Designation

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DRS Form 6 (Continued)

DATA REQUIREMENTS SHEETS for APPROACH CABLE

Seq	Parameter:	Unit:	Particulars:
32 .	Every day tensile stress	N	
33 .	Torsion	twist/m	

Thermal Properties of Cable

34 .	Coefficient of linear expansion:	per °C	
35 .	Coefficient of expansion Cladding: Core:	 per °C per °C	
36 .	Nominal operating temperature range:	°C	

CABLE SPOOL and DRUM

Seq	Parameter:	Unit:	Particulars:
37.	Available length per spool Maximum: Nominal:	m	
38.	Size of drum:	m	
39.	Weight of empty drum:	kg	
40.	Weight of drum with cable: spooled	kg	
41.	Will drum length scheduling be practiced to match transmission line span lengths?	Yes/No	

42. Describe Drum materials:

43. Describe cable end capping and protection against abrasion etc.:

DRS Form 6 (continued)

DATA REQUIREMENTS SHEETS for APPROACH CABLE

INSTALLATION			
Seq	**Parameter:**	**Unit:**	**Particulars:**
44.	Splice Loss: Maximum: Average:	 dB dB	
45.	Operating Temperature Range:	°C	
46.	Expected Cable Life:	Years	

47. Describe Installation method(s) and the cable duct parameters for installation of approach cable:

Signature

Name

Designation