

## Enquiry



**Bharat Heavy Electricals Limited**  
Transmission Business Group  
Materials Management

**Project : NPGCPL NABHINAGAR STPP**

Enquiry No	Enquiry Dt	Rev No	Rev Dt	PI No	Enquiry Type	Inspection by	Due Dt	Commercial Comments	Technical Comments	Signing Authority
144E088	01-Aug-14	0		342240009	Package		29-Aug-14	This Open Tender Enquiry [NIT No. 18816 on BHEL Website] is due on 29/08/2014. Please submit your offer otherwise provide regret letter for not submitting the offer to BHEL mentioning the cause for the same.	As per Technical Specification No. TB-350-510-032 Rev. 00. The bid of bidder will be accepted subject to vendor approval by customer (Please submit credential in the format attached with enquiry.	Sr. Engineer / TBMM

### 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

SN	Equipment	Phy Unit	Qty	Unit Exworks	% ED	% CST	Unit F&I	Plan Dt	Comments
1	OPGW AND ACCESSORIES	LOT	1					30-Sep-14	TECHNICAL DETAILS AS PER BHEL SPECIFICATION NO. TB 350 510 032, REV 0
2									
3									
4	12 Fibre OPGW cable	Km	11						
5	OPGW cable Accessories – OPGW Suspension Clamps	Nos.	19						
6	OPGW cable Accessories – OPGW Tension Clamps (Single, with earthing bonds)	Nos.	28						
7	OPGW cable Accessories – OPGW Grounding and Parallel Groove Clamps	Nos.	34						
8	OPGW cable Accessories – OPGW Vibration Dampers	Nos.	62						
9	OPGW cable Accessories – Armor Rods for OPGW	Nos.	19						
10	OPGW cable Accessories – Way Joint Box for OPGW	Nos.	7						
11	OPGW cable Accessories – 12 fibre Underground armoured fibre optic approach cable	Km	1						
12	OPGW cable Accessories – Installation hardware set including ties/clips/cleats, conduits, ducts, supports, fittings, accessories etc. for approach cable	Set	1						
13	OPGW cable Accessories – Indoor-type, Rack-mounted, 12F Fibre Optic Distribution Panel (FODP) including pigtailed and FCPC coupling	Nos.	2						
14	Services – Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	33						
15	Services – Termination & splicing of OPGW cable and approach cable	Lot	1						
16	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:**

WHOEVER 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](mailto: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 vendors who has sent offers with password, the passwords are to be forwarded to another email id: [supplierinfo@bhelinindustry.com](mailto:supplierinfo@bhelinindustry.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.

*Archana*

for BHARAT HEAVY ELECTRICALS LTD

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**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  
~~Bipin Kumar Mondal~~  
~~Dy. General 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

*S. C. Shivhare (Sr. Manager)*

Ph: 0120-6748581  
Fax: 0120-6748581

Signature and Seal of Tenderer

Enquiry No : 144E088      Enquiry Dt : 01-Aug-14

**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. 144E088      DATED 01/08/2014      DUE ON 29/08/2014
1.	<p>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.</p> <p>2. Bidder to ensure that quotation is received / dropped in the tender box on or before <b>14.00</b> Hrs. as per Indian standard time (IST) of the due date of opening in <b>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</b></p> <p>3. The tenders will be opened on due date at <b>14.30</b> 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.</p> <p>4. Bids are to be submitted in Two parts:</p> <p><b>Part-I: Qualification Criteria/Technical / Commercial Bid ( in two copies)</b></p> <p><b>Part-II: Price Bid</b></p> <p><b>Part-I Envelopes super scribed with Technical / Commercial Bid to contain information regarding, among others:</b></p> <ol style="list-style-type: none"><li>1. Specification</li><li>2. Deviations (if any) in deviation sheet of BHEL's Format.</li><li>3. All commercial terms, Un-priced copy of Price Bid with units for measurement.</li><li>4. Delivery terms &amp; period required for supply from order, Filled in activity Schedule format</li><li>5. Evidence for Qualification criteria.</li></ol> <p><b>Part-II</b> 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.</p> <p>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.</p> <p><b>Note: 1 Representative deputed to witness tender opening must produce an authority letter from the signatory of offer at the time of tender opening.</b></p> <p><b>Note: 2 Authorized signatory should authenticate tender documents.</b></p> <p><b>Note: 3 The bid of bidder will be accepted subject to vendor approval by Customer.</b></p>

Sr. No	ENQUIRY NO. 144E088      DATED 01/08/2014      DUE ON 29/08/2014
	<p>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</p> <p>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</p> <p>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.</p> <p>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.</p>
2.	<p><b>PRICES:</b></p> <p><b>A. Prices shall remain firm during entire contract period.</b></p> <p><b><u>Project Status:</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.</b></p> <p><b>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.</b></p> <p><b><u>For Foreign Bidder:</u></b></p> <p><b>The break-up of the prices shall be as mentioned in the schedule of price format.</b></p> <ol style="list-style-type: none"> <li>i. FOB / CIF (Port of loading) including sea worthy packing &amp; forwarding charges.</li> <li>ii. Marine Freight. From load port to discharge port</li> <li>iii. Insurance. ....do.....</li> <li>iv. Vendor to mention Port of Loading (.....)</li> <li>v. Destination Port (Mumbai or Chennai)</li> </ol> <p><b>Foreign vendors to quote Freight &amp; Insurance charges from port of loading to port of discharge (Mumbai or Chennai). However, in case of insurance by foreign vendor, the beneficiary shall be BHEL only. Custom Clearance, Payment of Custom Duty shall be in BHEL Scope.</b></p>

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	<p><b><i>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 &amp; duties involved till delivery of goods at site. However, foreign vendor can also quote for inland transport (From Mumbai or Chennai Port to Nabhinagr Site).</i></b></p> <p><b><u>Type Test charges:</u></b> As mentioned in technical specification – <b>The supplier shall conduct the type tests as per relevant IEC standards and no extra cost shall be paid by BHEL.</b></p> <p><b><u>Charges for Services Portion:</u></b> As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.</p> <p><b>Service Tax:</b> Applicable for Services Portion as per the current prevailing rate in India.</p> <p><b><u>For Indigenous bidder:</u></b></p> <p>The prices are to be quoted on <b>FOR</b> (Destination) basis. The break-up of price shall be as under:-</p> <p><b>a) Ex-works Price:</b> Ex- works price including packing &amp; forwarding charges.</p> <p><b>b) Excise duty:</b> PAC shall be issued by Customer / BHEL.</p> <p><b>c) Sales Tax:</b> 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.</p> <p><b>d) Entry tax / Octroi Charges:</b> Any Entry tax / Octroi applicable at destination / destination state shall be paid extra on proof of such payment.</p> <p><b>e) Freight &amp; Insurance:</b> Freight and Transit Insurance for door delivery up to destination/store is to be quoted.</p> <p><b>f) Service Tax:</b> Applicable for Services Portion as per the current prevailing rate in India.</p> <p><b>g) Type Test charges:</b> As mentioned in technical specification – <b>The supplier shall conduct the type tests as per relevant IEC standards and no extra cost shall be paid by BHEL.</b></p> <p><b>h) <u>Charges for Services Portion:</u></b> As mentioned in the technical specification, is to be quoted separately along with applicable taxes and duties on them.</p> <p><b><u>NOTE:</u></b>  <b>The purchase order shall be placed on Ex- Works basis for Indian Vendor.</b>  <b>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 &amp; I charges from discharge port to site shall be loaded on CIF value quoted by the overseas vendors.</b></p> <p><b>“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.</b></p>

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	<p>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 &amp; Conditions Of Reverse Auction Page 1 &amp; 2)</p>
3.	<p><b><u>TERMS OF PAYMENT:- For Overseas Vendors:</u></b></p> <p><b><u>FOR SUPPLY PORTION:-</u></b></p> <p>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.</p> <p><b>90%</b> against original invoice, original bill of lading, packing list, MICC (dispatch clearance given by BHEL), guarantee certificate, transit insurance certificate, certificate of origin.</p> <p>ii) <b>“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.”</b></p> <p><b>NOTE:</b> 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.</p> <p><b><u>FOR SERVICES:-</u></b>100% direct payment within 60 days after acceptance of the services work by BHEL.</p> <p><b><u>TERMS OF PAYMENT:- For Indian Vendors:</u></b></p> <p>100 % Payment with Taxes, Duties, Freight &amp; 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):</p> <ul style="list-style-type: none"> <li>- Receipted LR</li> <li>- Excise invoice (If Applicable)</li> <li>- Delivery Challan or Packing list (casewise)</li> <li>- Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers</li> <li>- MICC</li> <li>- Guarantee Certificate</li> <li>- Copy of Performance Bank Guarantee.</li> </ul> <p>[A.] Documents to be furnished by vendor immediately after dispatch:</p> <ul style="list-style-type: none"> <li>- Copy of Invoice</li> <li>- Copy of LR</li> <li>- Copy of Delivery Challan / Packing List</li> <li>- Copy of Insurance Certificate</li> <li>- Copy of Guarantee Certificate</li> </ul> <p>[B.] Following Documents to be sent by vendor to TBG, Noida:</p>

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	<ul style="list-style-type: none"> <li>- Receipted LR</li> <li>- Excise invoice (If Applicable)</li> <li>- Delivery Challan / Packing list (case wise)</li> <li>- Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers</li> <li>- Dispatch Clearance / MICC</li> <li>- Guarantee certificate</li> <li>- All Test &amp; Inspection Reports</li> </ul> <p><b><u>FOR SERVICES:-</u></b>100% direct payment within 60 days after acceptance of the services work by BHEL.</p> <p><b>INTEREST LIABILITY</b> In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment.</p>
4	<p><b>GUARANTEE:</b> 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.</p>
5.	<p><b><u>SECURITY CUM PERFORMANCE BANK GUARANTEE:</u></b></p> <p><b><u>OPTION -A</u></b></p> <p><b>For Overseas Vendors:</b> 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</p> <p><b>For Indian Vendors:</b> Bidder shall furnish along with first invoice Performance BG / deposit as per following options.</p> <p>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</p> <p>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.</p> <p>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.</p> <p><b><u>OPTION-B( Applicable for Indian as well as Overseas Vendors)</u></b> 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.</p> <p><b>If no option is specified, by default option – A shall be considered for confirmation</b></p>

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6.	<p><b><u>INSPECTION:</u></b> 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.</p> <p>BHEL / Customer may also carry out stage inspection during manufacturing of the ordered item.</p> <p>Supplier shall send inspection call on prescribed format only with an advance notice of 15 days.</p>
7.	<p><b><u>DISPATCH DOCUMENTS:</u></b> 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 &amp; approval of acceptance &amp; routine test certificates, Insurance certificate and manufacturer's guarantee certificate.</p>
8.	<p><b><u>DELIVERY PERIOD:</u></b> 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.</p> <p><u>Note:</u> 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.</p> <p><b>Vendors to quote the best and earliest possible delivery period.</b></p>
9.	<p><b><u>DELAYED DELIVERY:</u></b> 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 <b>maximum of 10 %</b> of total Ex-Works / FOB value of P.O. will be withheld.</p>
10.	<p><b><u>VALIDITY:</u></b> The offer shall be valid for 120 days from the due date of opening.</p>
11.	<p><b><u>ACCEPTANCE / REJECTION OF TENDER:</u></b> 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.</p>
12.	<p><b><u>EVALUATION:</u></b> Comparative statement shall be prepared based on overall quantity unless otherwise indicated in the enquiry. Evaluation of offers shall be done on the basis of delivered cost to BHEL.</p>
13.	<p><b><u>DEVIATION:</u></b> The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may <b>load the prices for evaluation of offer as mentioned at Sl. No. - 25.</b></p>
14.	<p><b><u>ARBITRATION:</u></b></p> <p>All cases of disputes emanating from and relating to this contract shall be referred to the sole arbitrator appointed by Unit Head / GM, BHEL. The arbitrator may be an employee of BHEL whether serving or retired or any other person nominated by Unit Head/GM BHEL. The arbitration shall be in accordance with 'The Arbitration and Conciliation Act 1996' and the rules there under as amended from time to time. The arbitrator shall give a reasoned award. The decision of the arbitrator shall be final &amp; binding upon both the parties.</p> <p>The venue of arbitration shall be Delhi.</p>
15.	<p><b><u>LEGAL SETTLEMENT:</u></b> All disputes shall be subject to jurisdiction of court situated in Delhi/New Delhi only.</p> <p>Notwithstanding contained herein anything in this NIT, the original exclusive jurisdiction shall remain of the court at Delhi / New Delhi.</p>

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16.	<b><u>SUBCONTRACTING :</u></b> 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.	<b><u>RISK PURCHASE:</u></b> 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.	<b><u>ADJUSTMENT OF RECOVERY:</u></b> 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.	<b><u>FORCE MAJEURE CONDITION:</u></b> 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	<b><u>DEMURRAGE / WHARFAGE:</u></b> 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	<b><u>Instructions for OEM:</u></b> 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	<b><u>Minimum Technical Qualifying Requirement:</u></b> <b>(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.</b> <b>AND</b> <b>(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.</b>  <u>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.</u>

Sr. No	<b>ENQUIRY NO. 144E088      DATED 01/08/2014      DUE ON 29/08/2014</b>
23	<p><b><u>Consignee Address:</u></b></p> <p>AGM (EED - Electrical) M/S NABINAGAR POWER GENERATING COMPANY PVT. LTD. SHIVANPUR, ANKORHA, NABINAGAR, AURANGABAD (BIHAR)-824303</p> <p>VAT. TIN.            -10172527023 CST. TIN.            -10172394156 E.T. TIN.             -10172359280 PAN NO.              -AACCN9448C ST. NO.                -AACCN9448CSD002</p>
24	<p><b>LOADING CRITERIA FOR DEVIATIONS TAKEN BY BIDDER ON:</b></p> <p><b><u>25.1 : TERMS OF PAYMENT:</u></b> 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:</p> <p>    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.</p> <p>    b) 60 days - No loading</p> <p><b><u>25.2 : DELAYED DELIVERY / PENALTY DUE TO DELAYED DELIVERY:</u></b> Loading for not accepting this clause / accepting only on un delivered portion shall be the maximum amount specified in this clause.</p>
25	<p><b>Indemnity (Against Patents / Trademarks etc) :</b></p> <p>The vendor shall at all times indemnify 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.</p>
26	<p><b>To and fro travelling expenses, Boarding and Lodging during services shall be borne by the vendor as per span mentioned in technical specification.</b></p>
27	<p><b>CONVERSION TO SINGLE CURRENCY:</b></p> <p>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.</p>
28	<p><b>FINAL ENGINEERING DOCUMENTATION:</b></p> <p>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.</p>
29	<p>“MSE suppliers can avail the intended benefit only if they submit along with offer, attested copies of either EM II certificate having deemed validity (Two years from the date of issue of acknowledgement in EM II) or valid NSIC certificate or EM II certificate along with CA certificate (Format enclosed as per Annexure - 1) applicable for the year, certifying quantum of investment in plant and machinery within the permissible limit as per the act for relevant status (Micro or Small) where the deemed validity of EM II is over. Date to be reckoned for determining the deemed validity will be the last date of technical</p>

Sr. No	<b>ENQUIRY NO. 144E088      DATED 01/08/2014      DUE ON 29/08/2014</b>
	bid submission. Non submission of such documents will lead to consideration of their bid at par with other bidders and MSE status of such suppliers shall be shifted to Non MSE supplier till the supplier submits these documents”.

**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.

## BHEL UN-PRICE BID FORMAT FOR SERVICE PART

Enquiry No: 144E088 dated 01/08/2014  
 Project: NPGCPL NABHINAGAR STPP  
 item: 220 kV Cable & Accessories

S.N	PI-ITEM	Unit	Qty	Currency	Unit Charges	Total Charges	Service taxes, if applicable in INDIA	Total Cost to BHEL for indian supplier for each line item	Total cost to BHEL for foreign supplierfor each line item
<b>Instrcutio</b> n 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 ]
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						
<b>A</b>	<b>Total Charges =</b>								
<b>B</b>	<b>Total Service Taxes =</b>								
<b>Total cost to BHEL for service portion in case of Indian supplier in Indian Currency ( A + B )=</b>									
<b>Total cost to BHEL for service portion in case of foreign supplier in foreign currency ( A + B )=</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 SERVICE PART

Enquiry No: 144E088 dated 01/08/2014  
 Project: NPGCPL NABHINAGAR STPP  
 item: 220 kV Cable & Accessories

S.N	PI-ITEM	Unit	Qty	Currency	Unit Charges	Total Charges	Service taxes, if applicable in INDIA	Total Cost to BHEL for indian supplier for each line item	Total cost to BHEL for foreign supplierfor each line item
<b>Instrcutio n to bidder-----&gt;</b>							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 ]
1	Supervision of Installation of OPGW alongwith its accessories and approach cable – Span-wise	Lot	33						
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<b>Total cost to BHEL for service portion in case of foreign supplier in foreign currency ( A + B )=</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. 144E088

DATE: 01/08/2014

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 within 3 working days.
5.	Manufacturing Time		Manufacturing time be indicated considering all constrains & must include time required for internal inspections etc.
6	Raise inspection call	-VE 2 WEEKS TO SL NO 5	Call for inspection must be raised at least two weeks in advance in the prescribed format. Non availability of offered material for inspection to the inspector will be viewed very seriously & may result in financial implications. The date of inspection must be with in the period indicated in 5 above.
7	Inspection	BHEL	
8	Issue of MICC, MDCC & other documents like EDEC , Road permits etc	BHEL	Vendor must indicate requirement well in advance.
9	Dispatch	ONE WEEK	Vendor must ensure to dispatch with in one Week of receiving all documents required
10	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

**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 .....

Signature of the authorized representative of

Date .....

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 .....

Signature of the authorized representative of

Date .....

Bidder's Name .....

Designation .....

Company seal .....

Enquiry No 144E088 Dated 01/08/2014

**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.

<b>Sl. No.</b>	<b>Terms &amp; Conditions</b>
1.0	<b><u>SCOPE OF WORK:</u></b> As per Technical Specification attached with this enquiry.
2.0	<b><u>COMMENCEMENT OF WORK:</u></b> Project start / zero date / Readiness at site for this work shall be intimated by BHEL.
3.0	<b><u>COMPLETION SCHEDULE:</u></b> 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	<b><u>OVER RUN CHARGES:</u></b> No over run charges are payable.
5.0	<b><u>IDLE LABOUR CHARGES:</u></b> 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	<b><u>SECURITY-CUM-PERFORMANCE GUARANTEE:</u></b> 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	<b><u>INSURANCE:</u></b> 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	<b><u>GUARANTEE:</u></b> 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	<b><u>TERMS OF PAYMENT:</u></b> The terms of payment shall be as specified under Clause 3 of General Terms and Conditions of this Enquiry.
10.0	<b><u>ESCALATION / PRICE VARIATION:</u></b> Prices shall be firm for total contract period and extended period, if any, and no price escalation / price variation will be applicable.
11.0	<b><u>COMPENSATION FOR DELAY IN EXECUTION:</u></b> 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	<b><u>ADDITIONAL EXPENDITURE:</u></b> 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	<b><u>REGULATION OF LOCAL AUTHORITIES AND STATUS :</u></b> The contractor shall adhere to the regulation of local authorities and status.
14.0	<b><u>DISCIPLINE OF WORKMEN:</u></b> The contractor shall adhere to the disciplinary procedure set by the owner in respect of his employees and workman at site.
15.0	<b><u>FORCE MAJEURE:</u></b> The force majeure shall be as specified under Clause 19 of General Terms and Conditions of this Enquiry.
16.0	<b><u>ARBITRATION:</u></b> 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

**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 on  
date..... 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

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.

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant







**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**

*[Handwritten signatures and marks]*

**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 & System11. 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



**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

*(Handwritten signatures and marks)*



**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

*(Handwritten signatures and marks)*



**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


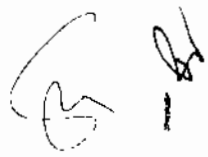



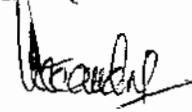
*[Handwritten signatures and marks]*



**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.



**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				



**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)

Handwritten signatures and marks at the bottom of the page, including a circled '53' and a signature.



**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?



### 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

55

*[Handwritten signatures and marks]*

*[Handwritten '55' in a circle]*



**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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*[Handwritten signatures and initials]*



**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 : \_\_\_\_\_

*[Handwritten signatures and initials]*

APPENDIX-Q3

MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN				PROJECT :				
ITEM :		ACCEPTANCE NORMS		FORMAT OF RECORD		AGENCY		REMARKS		
SUB-SYSTEM:		REFERENCE DOCUMENT		QUANTUM OF CHECK		TYPE OF CHECK		CLASS		
QP NO.:		M		C/N		5.		4.		
REV. NO.:		6.		7.		8.		9.		
DATE:		D*		10.		11.				
PAGE: .... OF ....										
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.

MANUFACTURER/ SUB-SUPPLIER		SIGNATURE		FOR NTPC USE		REV. .... CAT. ....	
MAIN SUPPLIER				REVIEWED BY		APPROVED BY	
				APPROVAL SEAL			

LEGEND: \* RECORDS IDENTIFIED 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.  
 C/P: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"

ENG. DIV./QA&I

1/1

FORMAT NO.: QS-01-QAL-P-09/F1-R1

*Handwritten signature*

*Handwritten initials*

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*Handwritten marks and signatures at the bottom of the page.*

APPENDIX-05

SUPPLIER'S LOGO		SUPPLIER'S NAME AND ADDRESS		FIELD QUALITY PLAN					PROJECT PACKAGE CONTRACT NO.: MAIN-SUPPLIER:	
ITEM:		SUB-SYSTEM:		CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
SL. NO	ACTIVITY AND OPERATION	CHARACTERISTICS/INSTRUMENTS	3.	4.	5.	6.	7.	8.	9.	10.
1.										

MANUFACTURER/SUB-SUPPLIER		SIGNATURE		DOC. NO.:		REV. ....	
MAIN-SUPPLIER				FOR NTPC USE		APPROVED BY	
				REVIEWED BY		APPROVAL SEAL	

LEGEND: 4 RECORDS IDENTIFIED 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 FOA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)

FORMAT NO.: QS-01-QA1-P-09/F2-R1

*(Handwritten marks and signatures)*

*(Handwritten signature)*

(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, 5<sup>th</sup> 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 precious consent of the company in writing and agree that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the Seller or the guarantor shall not discharge the Guarantor's liability here under.

( 3 )

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	RD	VK	RS	
TITLE  OPGW ALONGWITH ACCESSORIES		SIGN	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	
		DATE	20/04/19	5/5/14	5/5/14	
		GROUP	TBEM	W.O. No	81004	
		CUSTOMER	NABINAGAR POWER GENERATING CO. PVT. LIMITED (NPGC) (A Joint Venture of NTPC Ltd. And Bihar State Electricity Board)			
CONSULTANT	---					
PROJECT	400/132 KV SWITCHYARD PACKAGE AT NABINAGAR SUPER THERMAL POWER PROJECT (3 X 660 MW)					

### CONTENTS

Sec. No.	Description	No. of Sheets
1.	Scope and Quantities	03
2.	Equipment Specification	25
3.	Project Details & General Technical Requirements	30
4.	Guaranteed Technical Particulars	20

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Rev No.	Date	Altered	Checked	Approved	<b>REVISION DETAILS</b>
Distribution			To	TBTS	O/C
			Copies	-	1
				TBMM	TBQM
				-	-
				TBCM	1

**Project: 400/132 kV Switchyard Package at  
Nabinagar Super Thermal Power Project (3 X 660 MW)  
Customer: Nabinagar Power Generating Co. Pvt. Limited (NPGC)  
Consultant: ----  
Technical Specification: OPGW**

**Bharat Heavy Electricals Limited  
Document No. TB 350 510 032**

## SECTION 1 SCOPE AND QUANTITIES

### 1.0 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 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. 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 customer (NPGC/NTPC). 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.

### 1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

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)

Refer Section - 3 for Project Details and General Specifications.

## 1.2 BILL OF QUANTITIES

Sl. No.	Item Description	Unit	Quantity
1.	<b>12 Fibre OPGW cable</b>	Km	11
2.	<b>OPGW cable Accessories – Installation Hardware set for 12 fibre OPGW Cable consisting of following:</b>		
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.	Aarmor 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.	<b>Services consisting of following:</b>		
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  $\pm 10\%$  at contract stage.

## 1.3 TYPE TEST REQUIREMENTS

At contract stage, the reports for all type tests shall be submitted for NPGC/NTPC 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 accreditation body of the country where laboratory is located) or witnessed by the representatives(s) of NPGC/NTPC 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

**Project: 400/132 kV Switchyard Package at  
Nabinagar Super Thermal Power Project (3 X 660 MW)  
Customer: Nabinagar Power Generating Co. Pvt. Limited (NPGC)  
Consultant: ----**

**Bharat Heavy Electricals Limited  
Document No. TB 350 510 032**

**Technical Specification: OPGW**

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 NPGC/NTPC 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.

**1.4 INSPECTION, TESTING AND ACCEPTANCE**


Bidder has to follow specification and NPGC/NTPC approved Manufacturing Quality Plan.


**1.5 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	<p>Pins and Caps: Pins and Caps shall be made of drop forged steel and malleable cast iron/spheroidal graphite iron/drop forged steel respectively, duly hot dip galvanized and shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material.</p>																					
7.02.06	<p>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.</p>																					
7.03.00	<p><b>Hot Line Maintenance</b></p> <p>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.</p> <p>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.</p>																					
7.04.000	<p><b>OPGW and its accessories</b></p>																					
7.04.01	<p>General</p> <p>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.</p>																					
7.04.02	<p>Construction</p> <p>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.</p> <p>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.</p>																					
7.04.03	<p>Optical Fiber Characteristics</p> <p>Optical fiber shall be supplied in accordance with ITU – T Recommendation G.652 with the following requirements.</p> <table border="0" data-bbox="363 1473 1182 1771"> <tr> <td>Profile of Optical Fiber:</td> <td>Single mode stepped index</td> </tr> <tr> <td>Average Transmission Loss:</td> <td></td> </tr> <tr> <td>At wavelength 1310 nm</td> <td>0.38 dB per km maximum</td> </tr> <tr> <td>At Wavelength 1550 nm</td> <td>0.25 dB per km maximum</td> </tr> <tr> <td>Number of Fiber</td> <td>12</td> </tr> <tr> <td>Average splicing loss:</td> <td>0.05db per joint</td> </tr> <tr> <td>Maximum splicing loss:</td> <td>0.10 dB per joint</td> </tr> <tr> <td>Mode field diameter (MFD):</td> <td>9.0µm ± 1.0µm</td> </tr> <tr> <td>Cladding diameter:</td> <td>125 ± 2 µm</td> </tr> <tr> <td>Core / Cladding</td> <td></td> </tr> </table>	Profile of Optical Fiber:	Single mode stepped index	Average Transmission Loss:		At wavelength 1310 nm	0.38 dB per km maximum	At Wavelength 1550 nm	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		
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Core / Cladding																						
<p>NABINAGAR STPP (3X660MW) 400/132kV SWITCHYARD PACKAGE</p>	<p>Bid Doc. No.: CS-0370-572-2</p>	<p>TECHNICAL SPECIFICATIONS</p>	<p>PART-III SECTION-VI</p>	<p>Page T4-11/14</p>																		

Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 																																												
7.04.04	<p>Mode field concentricity error: 1µm  Chromatic – dispersion coefficient @ 1310 nm 3.5 ps / nm km. Maximum  Chromatic – dispersion coefficient @ 1550 nm 20 ps / nm km. Maximum  Fiber Identification: each fiber shall be uniquely identifiable throughout the length of the wire.  Operating Temperature: 0°C to 80 °C continuously</p> <p><b>OPGW Characteristics</b></p> <table border="0"> <tr> <td>Ultimate tensile strength</td> <td>(kg)</td> <td>≥</td> <td>7,500</td> </tr> <tr> <td>Outside diameter</td> <td>(mm)</td> <td>≤</td> <td>14</td> </tr> <tr> <td>Cross sectional area of Conduct</td> <td>(mm<sup>2</sup>)</td> <td>≥</td> <td>80</td> </tr> <tr> <td>D.C. Resistance @ 20 °C</td> <td>(Ω/km) ≤</td> <td></td> <td>0.76</td> </tr> <tr> <td>Length per reel</td> <td>(m)</td> <td></td> <td>3000 Approx.</td> </tr> <tr> <td>Modulus of elasticity</td> <td>(kg/mm<sup>2</sup>)</td> <td>≥</td> <td>10,000</td> </tr> <tr> <td>Coefficient of linear expansion</td> <td>(/°C)</td> <td>≤</td> <td>15.0 x 10<sup>-6</sup></td> </tr> <tr> <td>Capacity fault current (KA)<sup>2</sup> sec.</td> <td></td> <td></td> <td>46</td> </tr> <tr> <td>Maximum allowable temp. For optical fiber in loose type (°C)</td> <td></td> <td></td> <td>160</td> </tr> <tr> <td>Maximum Transmission Loss Change – Temperature Range 0°C to 150 °C</td> <td>(dB/km)</td> <td></td> <td>0.1</td> </tr> <tr> <td>Unit Weight</td> <td>(kg./km)</td> <td>≤</td> <td>600</td> </tr> </table> <p>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.</p>	Ultimate tensile strength	(kg)	≥	7,500	Outside diameter	(mm)	≤	14	Cross sectional area of Conduct	(mm <sup>2</sup> )	≥	80	D.C. Resistance @ 20 °C	(Ω/km) ≤		0.76	Length per reel	(m)		3000 Approx.	Modulus of elasticity	(kg/mm <sup>2</sup> )	≥	10,000	Coefficient of linear expansion	(/°C)	≤	15.0 x 10 <sup>-6</sup>	Capacity fault current (KA) <sup>2</sup> 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
Ultimate tensile strength	(kg)	≥	7,500																																										
Outside diameter	(mm)	≤	14																																										
Cross sectional area of Conduct	(mm <sup>2</sup> )	≥	80																																										
D.C. Resistance @ 20 °C	(Ω/km) ≤		0.76																																										
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Coefficient of linear expansion	(/°C)	≤	15.0 x 10 <sup>-6</sup>																																										
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Maximum Transmission Loss Change – Temperature Range 0°C to 150 °C	(dB/km)		0.1																																										
Unit Weight	(kg./km)	≤	600																																										
7.04.05	<p><b>Assemblies and Line Accessories</b></p> <p>a. General</p> <p>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.</p> <p>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.</p> <p>b. Suspension Clamps</p>																																												
<p style="text-align: center;">NABINAGAR STPP (3X660MW) 400/132kV SWITCHYARD PACKAGE</p>	<p style="text-align: center;">Bid Doc. No.: CS-0370-572-2</p>	<p style="text-align: center;">TECHNICAL SPECIFICATIONS</p>	<p style="text-align: center;">PART-III SECTION-VI</p>	<p style="text-align: center;">Page T4-12/14</p>																																									


Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
	<p>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.</p> <p>c. Tension Clamps</p> <p>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.</p> <p>d. Grounding clamps and Parallel Groove Clamp</p> <p>Each clamp shall be capable holding the OPGW using bolts and nuts.</p> <p>e. Vibration dampers</p> <p>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.</p> <p>f. Armor rods</p> <p>The armor rods for the OPGW shall be of the preformed type. They shall be smooth and free from corrosion, splitting, cracking, or any other defects. They shall be designed to effectively protect the OPGW from fatigue caused by vibration.</p> <p>Armor rods may or may not be employed, as per OPGW manufacturer recommendations, however the use of armor rods is preferred by the Employer.</p> <p>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.</p> <p>The contractor shall provide one set of terminating materials with every joint box for optical fiber connection.</p> <p>1. <b>Way Joint Box for OPGW</b></p>			
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Clause No.	TECHNICAL REQUIREMENTS 			
	<p>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.</p> <p><b>2. Way Joint Box for OPGW and approach cable</b></p> <p>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.</p>			
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Clause No.	TECHNICAL REQUIREMENTS			
<b>CHAPTER – T5 : TESTS FOR 400KV TL. LINE MATERIAL</b>				
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			
NABINAGAR STPP (3X660MW) 400/132KV SWITCHYARD PACKAGE	Bid Doc. No.: CS-0370-572-2	TECHNICAL SPECIFICATIONS	PART-III SECTION-VI	Page T5-1/21


Clause No.	TECHNICAL REQUIREMENTS			
2.03.03 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  2.03.04 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)	Spacer for Line  Rigid Spacer for jumper (For Twin ACSR 'MOOSE')	As per specification enclosed		
2.03.05 a) Slip strength test - As per specification enclosed	Flexible Copper Bond.			
2.03.06 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	Vibration Damper for Conductor and Earthwire.			
2.03.07 a) Mechanical strength Test - As per specification enclosed b) Clamp Slip Strength vs Torque test for suspension assembly - As per specification enclosed.	Earthwire Suspension clamp Assembly			
2.03.08 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	Earthwire Tension Clamp Assembly			
2.04.00  2.04.01 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.	Hardware Fittings  On the complete insulator string with hardware fittings			
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Clause No.	TECHNICAL REQUIREMENTS			
	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			
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Clause No.	TECHNICAL REQUIREMENTS			
	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 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)			
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Clause No.	TECHNICAL REQUIREMENTS			
	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) Galvanising/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	<b>ROUTINE TESTS</b>			
4.01.00	Earthwire			
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Clause No.	TECHNICAL REQUIREMENTS			
	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			
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Clause No.	<b>TECHNICAL REQUIREMENTS</b> 			
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	<b>TESTING EXPENSES</b>			
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, <del>except for the expenses of the Inspector/Owner's representative.</del>			
7.00.00	<b>SAMPLE BATCH FOR TYPE TESTING</b>			
	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	<b>ADDITIONAL TESTS</b>			
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	<b>TESTS REPORTS</b>			
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.			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
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	<b>INSPECTION</b>			
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.			
<p style="text-align: center;">NABINAGAR STPP (3X660MW) 400/132kV SWITCHYARD PACKAGE</p>	<p style="text-align: center;">Bid Doc. No.: CS-0370-572-2</p>	<p style="text-align: center;">TECHNICAL SPECIFICATIONS</p>	<p style="text-align: center;">PART-III SECTION-VI</p>	<p style="text-align: center;">Page T5-8/21</p>


Clause No.	TECHNICAL REQUIREMENTS	
<b>NORMS AND PROCEDURES OF TESTS</b>		<b>ANNEXURE - A</b>
1.00.00	<b>TESTS ON EARTHWIRE</b>	
1.01.00	<b>UTS Test</b>  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	<b>DC Resistance Test</b>  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	<b>Visual Check for joints</b>  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	<b>Torsion Test</b>  The number 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	<b>Visual check on Drums</b>  The drums shall be visually checked to ensure that they conform to his specification.	
1.06.00	<b>Dimensional Check</b>  The individual strands shall be dimensionally checked to ensure that they conform to the requirements of this specification.	
1.07.00	<b>Lay length Check</b> The lay length shall be checked to ensure that they conform to the requirements of this specification.	
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
1.08.00	<p><b>Galvanising Test</b></p> <p>The test procedure shall be as specified in IS:4826-1968. The material shall conform to the requirements of this specification.</p>			
1.09.00	<p><b>Chemical Analysis of Zinc used for Galvanising</b></p> <p>Samples taken from zinc ingots shall be chemically / spectrographically analysed. The same shall be in conformity to the relevant standards.</p>			
1.10.00	<p><b>Chemical Analysis of Steel</b></p> <p>Sample taken from the steel ingots/coils/strands shall be chemically / spectrographically analysed. The same shall be in conformity to the relevant standards.</p>			
2.00.00	<p><b>TESTS ON CONDUCTOR</b></p>			
2.01.00	<p><b>UTS Test On Stranded Conductor</b></p> <p>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.</p>			
2.02.00	<p><b>DC Resistance Test On Stranded Conductor</b></p> <p>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.</p>			
2.03.00	<p><b>Chemical Analysis Of Aluminum</b></p> <p>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.</p>			
2.04.00	<p><b>Visual And Dimensional Check On Drums</b></p> <p>The drums shall be visually and dimensionally checked to ensure that they conform to the requirements of this specification.</p>			
2.05.00	<p><b>Visual Check For Joints, Scratches, etc.</b></p>			
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Clause No.	TECHNICAL REQUIREMENTS			
	<p>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.</p>			
2.06.00	<p><b>Dimensional Check On Aluminium Strands</b></p> <p>The individual strands shall be dimensionally checked to ensure that they conform to the requirement of this specification.</p>			
2.07.00	<p><b>Check For Lay-Rations Of Various Layers</b></p> <p>The lay-rations of various layers shall be checked to ensure that they conform to the requirements of this specification.</p>			
2.08.00	<p><b>Elongations Test</b></p> <p>The test procedure shall be as specified in IS-398 (Part-IV)-1979. The material shall conform to the requirements of this specification.</p>			
2.09.00	<p><b>Breaking Load Test On Welded Aluminium Strand</b></p> <p>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.</p>			
3.00.00	<p><b>CONDUCTOR AND EARTHWIRE ACCESSORIES</b></p>			
3.01.00	<p><b>Mid Span Compression Joint for Conductor and Earthwire</b></p>			
3.01.01	<p><b>Slip Strength Test</b></p> <p>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.</p>			
3.01.02	<p><b>Hardness Test</b></p> <p>The Brineel hardness at various points on the earthwire compression joint and tension clamp shall be measured.</p>			
3.02.00	<p><b>Flexible Copper Bond</b></p> <p>Slip Strength Test</p>			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
<p>3.03.00</p> <p>3.03.01</p> <p>3.03.02</p>	<p>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.</p> <p>Vibration Damper for Conductor and Earthwire</p> <p>Dynamic Characteristics Tests</p> <p>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.</p> <p>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:</p> <p>i) Reactance Vs frequency. ii) Phase angle Vs frequency. iii) Power dissipation Vs frequency.</p> <p>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.</p> <p>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.</p> <p>Where <math>F1 = 2 f_i</math> and <math>F2 = 0.5 f_i</math> for vibration damper for conductor / earthwire</p> <p>Where <math>f_i = 2 \times 2 \pi f \sqrt{TM}</math> T = tension of conductor M = mass of conductor</p> <p>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.</p> <p>Vibration Analysis</p> <p>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:</p>			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
<p>3.03.03</p>	<p>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.</p> <p>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.</p> <p>c) The power dissipation curve obtained from dynamic characteristic. Test shall be used for analysis with damper.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p><b>3.03.03 Clamp Slip and Fatigue Tests</b></p> <p>a) <b>Test Set Up</b></p> <p>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.</p>			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
<p>b)</p> <p>c)</p>	<p><b>Clamp Slip Test</b></p> <p>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.</p> <p><b>Fatigue Test</b></p> <p>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 <math>\pm 25 / f</math> mm, where f is the frequency in Hz.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>For the purpose of acceptance, the following criteria shall be applied:</p> <ol style="list-style-type: none"> <li>i) There shall not be any frequency shift by more than <math>\pm 2</math> Hz for frequencies lower than 15 Hz and <math>\pm 3</math> Hz for frequencies higher than 15 Hz.</li> <li>ii) The percentage variation in reactance curve after fatigue test shall lie within the limit which is to be guaranteed by the manufacturer.</li> <li>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.</li> <li>iv) The deterioration of characteristics in respect of reactance and power dissipation shall be compared with respect to guaranteed value.</li> </ol>			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
3.03.04	<p><b>Verification of Resonance Frequencies</b></p> <p>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.</p>			
3.03.05	<p><b>Clamp Bolt Torque Test</b></p> <p>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.</p>			
3.03.06	<p><b>Strength of the Messenger Cable</b></p> <p>The messenger cable shall be fixed in a suitable tensile testing machine and the tensile load shall be gradually applied until yield point is reached. The load shall not be less than the value guaranteed by the Bidder.</p>			
3.03.07	<p><b>Mass Pull Off Test</b></p> <p>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.)</p>			
3.04.00	<p><b>Earthwire Suspension / Tension Clamp</b></p>			
3.04.01	<p><b>Mechanical Strength test</b></p> <p>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.</p>			
3.04.02	<p><b>Clamp Slip Strength Vs Torque Test for Suspension assembly.</b></p> <p>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</p>			
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Clause No.	<b>TECHNICAL REQUIREMENTS</b> 			
3.04.03	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	<b>Slip Strength Test of Tension Clamp</b>  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 be 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	<b>Resistance Test of Tension Clamp.</b>  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	<b>Hardness test.</b>  The Brineel hardness at various points on the steel portion of tension clamp shall be measured.			
3.04.06	<b>Magnetic Power Loss Test</b>  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	<b>Chemical Analysis Test for each components</b>  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	<b>Spacer for line &amp; Rigid spacer</b>			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
<p>3.05.01</p> <p>3.05.02</p>	<p><b>Clamp slip Test</b></p> <p>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.</p> <p><b>Vibration tests</b></p> <p>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.</p> <p>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.</p> <p>i) <b>Longitudinal Vibration Test.</b></p> <p>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.</p> <p>ii) <b>Vertical vibration Test</b></p> <p>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</p> <p><math>F^{1.8} Y_{max} &gt; 1000 \text{ mm/sec.}</math></p> <p>Where <math>Y_{max}</math> being the antinode displacement (mm) and <math>f</math> 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.</p> <p>iii) <b>Sub-span Oscillation Test</b></p> <p>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</p>			
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Clause No.	<b>TECHNICAL REQUIREMENTS</b> 			
3.05.03	<p>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.</p> <p>Ozone Test for Elastomer</p>			
3.05.04	<p>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.</p> <p>Compressive and Tensile Test</p> <p>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 <math>\pm 100</math> 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.</p>			
4.00.00	<p><b>HARDWARE FITTINGS AND INSULATORS</b></p>			
4.01.00	<p>Voltage Distribution Test</p> <p>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.</p>			
4.02.00	<p>Mechanical Strength Test for Complete String</p> <p>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.</p>			
4.03.00	<p>Vibration test</p> <p>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)</p>			
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Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
	<p>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 <math>900/(f^{**} 1.8)</math>, 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</p> <p>a) Temperature cycle test followed by mechanical performance test assembly per IEC:575 Clause 4.0 : 60% discs of be tested</p> <p>b) Puncture test : 40% discs of be tested</p> <p>4.04.00 Chemical analysis of zinc used for galvanising</p> <p>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.</p> <p>4.05.00 Test for forgings</p> <p>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.</p> <p>4.06.00 Tests on castings</p> <p>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 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.</p> <p>4.07.00 Hydraulic internal pressure tests on shells</p> <p>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.</p> <p>4.08.00 Thermal mechanical performance test</p> <p>The thermal mechanical performance test shall be performed in accordance with IEC-575, clause 3, with the following modifications:</p> <p>The applied mechanical load during this test shall be 70% of the rated electro-mechanical of mechanical value. The acceptance criteria shall be :</p> <p>a) <math>X &gt; R + 3S</math> where X = Mean value of the individual electro-mechanical/</p>			
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Clause No.	<b>TECHNICAL REQUIREMENTS</b> 			
<p>4.09.00</p> <p>4.10.00</p> <p>4.11.00</p> <p>4.12.00</p> <p>4.13.00</p>	<p>mechanical failing load.  R = Rated Electro-mechanical / mechanical failing load.  S = Standard deviation.</p> <p>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.</p> <p><b>Eccentricity Test :</b></p> <p>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 contact 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 move 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.</p> <p>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 its 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.</p> <p><b>Magnetic power Loss Test for Suspension Assembly</b></p> <p>Same as clause 3.04.06 above</p> <p><b>Clamp slip strength Vs Torque Test and clamp slip for AG Suspension Clamp / envelope type suspension clamp.</b></p> <p>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.</p> <p><b>Galvanising / Electroplating Test</b></p> <p>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 precece test shall be carried out and the results obtained shall satisfy the requirements of this specification.</p> <p><b>Mechanical Strength Test for welded Joints</b></p>			
<b>NABINAGAR STPP (3X660MW)  400/132kV SWITCHYARD PACKAGE</b>	<b>Bid Doc. No.:</b> CS-0370-572-2	<b>TECHNICAL  SPECIFICATIONS</b>	<b>PART-III  SECTION-VI</b>	<b>Page</b> T5-20/21

Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
	<p>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.</p>			
4.14.00	<p><b>Mechanical strength test of each component</b></p> <p>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.</p>			
4.15.00	<p><b>Test For Forging, Casting and Fabricated Hardware</b></p> <p>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.</p>			
5.00.00	<p><b>Corona Extinction Voltage Test (Dry)</b></p> <p>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.</p>			
6.00.00	<p><b>Radio Interference Voltage Test (Dry)</b></p> <p>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.</p>			
<p><b>NABINAGAR STPP (3X660MW) 400/132kV SWITCHYARD PACKAGE</b></p>	<p><b>Bid Doc. No.:</b> CS-0370-572-2</p>	<p><b>TECHNICAL SPECIFICATIONS</b></p>	<p><b>PART-III SECTION-VI</b></p>	<p><b>Page</b> T5-21/21</p>

## 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:

	<b>Particular</b>	<b>Details</b>	
a)	Customer	<b>Nabinagar Power Generating Company Pvt. Ltd. (NPGC)</b> (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	<b>Nabinagar STPP</b> (i.) Place : Nabinagar (ii) District : Aurangabad (iii.) State : Bihar	<b>Nabinagar TPP (BRBCL)</b> (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/m <sup>2</sup>
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### 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/1 <sup>st</sup> Level	2 <sup>nd</sup> Level	3 <sup>rd</sup> 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 than 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'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. 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 lamicaid.
- 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 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.

**3.10.3** 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 painting 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 identified 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(whenever 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) wherever 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 other agreed 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, the contractor 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 grounds 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 starting 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 from 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

Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
	<p style="text-align: right;"><b>Annexure – A</b></p> <p><b>CORONA AND RADIO INTERFERENCE VOLTAGE (RIV) TEST</b></p> <p><b>1.0 General</b></p> <p>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).</p> <p><b>2.0 Test Levels</b></p> <p>The test voltage levels for measurement of external RIV and for corona extinction voltage are listed under the relevant clauses of the specification.</p> <p><b>3.0 Test Methods for RIV:</b></p> <p><b>3.1</b> 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.</p> <p><b>3.2</b> Alternatively, RIV tests shall be in accordance with NEMA standard Publication No. 107 – 1964 except otherwise noted herein.</p> <p><b>3.3</b> 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.</p> <p><b>3.4</b> 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.</p> <p><b>3.5</b> The metering instruments shall be as per CISPR recommendations or equivalent device so long as it has been used by other testing authorities.</p>			
<p>NABINAGAR STPP (3X660MW) 400/132KV SWITCHYARD PACKAGE</p>	<p>Bid DOC. NO: CS-0370-572-2</p>	<p>TECHNICAL SPECIFICATIONS</p>	<p>PART-II SECTION-VI</p>	<p>Page E0- 5 of 8</p>

Clause No.	TECHNICAL REQUIREMENTS			
3.6	<p>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.</p>			
4.0	<p><b>Test Methods for visible Corona</b></p> <p>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.</p>			
4.1	<p>For recording purposes, modern devices using UV recording methods such as image intensifier may also be used.</p>			
4.2	<p>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.</p>			
4.3	<p>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. These four photographs shall be taken from four points equally spaced around the test arrangement to show its features from all sides. Drawings of the laboratory and test set up locations shall be provided to indicate camera positions and angles. The precise location of camera shall be approved by</p>			
NABINAGAR STPP (3X660MW)	Bid DOC. NO:	TECHNICAL	PART-II	Page
400/132kV SWITCHYARD	CS-0370-572-2	SPECIFICATIONS	SECTION-VI	E0- 6 of 8
PACKAGE				

Clause No.	TECHNICAL REQUIREMENTS 			
4.4	<p>purchaser's inspector after determining the best camera locations by trial energisation of test object at a voltage which results in corona. The test to determine the visible corona extinction voltage need not be carried out simultaneously with test to determine RIV levels.</p>			
4.5	<p>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.</p>			
5.0	<p><b>Test Records:</b></p> <p>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-</p> <ul style="list-style-type: none"> <li>a) Background noise before and after the test</li> <li>b) Detailed procedure of application of test voltage</li> <li>c) Measurement of RIV levels expressed in microvolts at each level.</li> <li>d) Results and observations with regard to location and type of interference sources detected at each step.</li> <li>e) Test voltage shall be recorded when measured RIV passes through 100 micro volt in each direction.</li> <li>f) Onset and extinction of visible corona for each of the four tests required shall be recorded.</li> </ul>			
NABINAGAR STPP (3X660MW) 400/132kV SWITCHYARD PACKAGE	Bid DOC. NO: CS-0370-572-2	TECHNICAL SPECIFICATIONS	PART-II SECTION-VI	Page E0- 7 of 8

Clause No.	<p style="text-align: center;"><b>TECHNICAL REQUIREMENTS</b></p> 			
	<p style="text-align: right;"><b>Annexure – B</b></p> <p style="text-align: center;"><b>SEISMIC WITHSTAND TEST (For 400kV Only)</b></p> <p>The seismic withstand test on the complete equipment (except BPI) shall be carried out along with supporting structure.</p> <p>The bidder shall arrange to transport the structure from his contractor's premises / owner's sites for purpose of seismic withstand test only.</p> <p>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.</p>			
NABINAGAR STPP (3X660MW) 400/132kV SWITCHYARD PACKAGE	Bid DOC. NO: CS-0370-572-2	TECHNICAL SPECIFICATIONS	PART-II SECTION-VI	Page E0- 8 of 8

SECTION-4  
GUARANTEED TECHNICAL PARTICULARS

DRS Form I

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:

Signature

Name

Designation

D-1

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 $\pm$ deviation)	mm	
20 .	Cable cross-section area (Nominal):	mm <sup>2</sup>	
21 .	Cable cross-section area (Effective):	mm <sup>2</sup>	
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 <sup>2</sup>	

- Continued -

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 <sup>2</sup>	
32 .	Maximum permissible tensile stress:	KN/mm <sup>2</sup>	
33 .	Permissible CTS. tensile stress:	KN/mm <sup>2</sup>	
34 .	Maximum sag at maximum temperature and design span with no wind:	mm	
35 .	Everyday tension at 32°C, no wind:	% of UTS	
36 .	Maximum tension at 32°C with full wind pressure of .....Kg/m <sup>2</sup> 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

D-4

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DRS Form 1 (Continued)

**DATA REQUIREMENTS SHEETS for**  
**OPTICAL POWERLINE GROUND WIRE (OPGW):**

<b>CABLE SPOOL and DRUM</b>			
<b>Seq</b>	<b>Parameter:</b>	<b>Unit:</b>	<b>Particulars:</b>
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

E-5

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DRS Form I (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	<u>Describe Installation method(s):</u>		

Signature

Name

Designation

E-6

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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 ( $\pm 25$ 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:	$\mu\text{m}$	
9.	Mode Field Diameter Deviation @ 1310 nm: @ 1550 nm:	$\mu\text{m}$	
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 <sup>2</sup> .km	
14.	Cut off wavelength:	nm	
15.	Refractive Index:		
16.	Refractive Index profile:		
17.	Cladding Design:		
18.	Numerical aperture:		

Signature

Name

Designation

F-7

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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	dB	
	(16mm radius, 1 turr.) @1550 nm	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 <sup>1/2</sup>	
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

E-8

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	$\pm\%$ $\pm\%$	
	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 \_\_\_\_\_

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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	$\pm\%$ $\pm\%$	
	n) Material of manufacture		
	o) UTS of each Rod	kN	
	p) Weight	kg	

Signature \_\_\_\_\_

Name \_\_\_\_\_

Designation \_\_\_\_\_

E-10

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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

E-11

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DRS Form 3-C  
DATA REQUIREMENTS SHEETS for  
OPGW HARDWARE AND FITTINGS

Vibration Damper:

Manufacturer: \_\_\_\_\_  
 Part #: \_\_\_\_\_

None

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 \_\_\_\_\_

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Name \_\_\_\_\_

Designation \_\_\_\_\_

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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

E-13

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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:
<b>Cable Termination Splice Accomodations:</b>			
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 organisers:		
21.	Excess length of fibre service loops		

Signature  
Name  
Designation

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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:

→

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Seq	Parameter:	Unit:	Particulars:
<b>Cable Termination Splice Accomodations:</b>			
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 organisers:		
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:		
22.	Installation Clearances Front Access: Rear Access: Top * Bottom * Sides:	m	
	Excess length of fibre service loops		

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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		

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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 <sup>2</sup>	
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 <sup>2</sup>	
26.	Equivalent Modulus of elasticity:	KN/mm <sup>2</sup>	
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 <sup>2</sup>	
30.	Maximum permissible tensile stress:	KN/mm <sup>2</sup>	
31.	Permissible CTS. tensile stress:	KN/mm <sup>2</sup>	

- 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.:

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DRS Form 6 (continued)

DATA REQUIREMENTS SHEETS for  
APPROACH CABLE

INSTALLATION			
Seq	Parameter:	Unit:	Particulars:
44.	Splice Loss:	Maximum:	dB
		Average:	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:

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