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. 224E220 DATED 06/02/2015 DUE ON 10/03/2015
1.	1. Sealed quotations are invited for the items mentioned in the enquiry. Quotations should be typed and free from over writing and erasures, corrections or additions must be clearly written both in words and figures and attested and otherwise offer may be rejected. 2. Bidder must ensure that their quotation is received / dropped in the tender box on or before 14.00 Hrs. of the due date of opening in ***Material Management Division*** ***Transmission Business Group*** ***Tower A, 5th Floor, BHEL, Advant Navis IT Business Park*** ***Plot No 7, Sector - 142, Express way Noida*** ***Noida -201305*** ***DISTT- GAUTAM BUDH NAGAR, UP*** 3. The same shall be opened at 14.30 Hrs. on the same day. Tenders received late shall be rejected. Bidders must ensure that tender documents are deposited on or before due date. 4. **Bids are to be submitted in Two parts:** i) **Techno-commercial bid (Part I)** – To be submitted in duplicate. A copy of price bid (Part II) (**without prices but clearly mentioning the taxes & duties applicable, if any**) is also to be enclosed in Part I bid as confirmation that the bidder has quoted for all the items mentioned in price bid format. ii) **Price bid (Part II)** – To be submitted only in one copy in a separate sealed envelope. This should not contain any Technical or Commercial Terms. The rates should be quoted both in figures and words. In case of any difference between figures and words, the quoted rate in words will prevail over figure. If there is a calculation mistake in multiplication of unit rate with quantity, then the unit rate quoted will be considered for calculation. Both Part I and Part II bids are to be sealed in separate envelope and both envelops to be kept in another common envelope. Each envelope should be sealed and super scribed with enquiry no., item / package name, project name and due date of opening. Note: Representative deputed to witness tender opening must produce an authority letter from the signatory of offer at the time of tender opening.

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	5. **For any Technical Clarification, please contact:** **SHRI VIVEK KAPIL, Sr. MANAGER / TBEM** **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 BUDH NAGAR, UP, INDIA** **Phone : 0120-06748539 / 9818080691** **E-mail : vivekk@bhel.in** **For any Commercial Clarification, please contact:** **SH. S.C. SHIVHARE, Sr. MGR.(TBMM) /** **SMT. ARCHANA KUMARI, Sr. ENGR. (TBMM)** **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 BUDH NAGAR, UP, INDIA** **Phone : 0120-6748467 / 0120-6748471** **Email: archanak@bhel.in / scshivhare@bhel.in** 6. Price bid should not contain any information / description / terms & condition other than given in Part-I of the bid except prices, otherwise bid is liable for rejection. 7. Price bid submitted along with the bid shall remain valid up to validity of offer. Unsolicited Supplementary / Revised price bid submitted during validity period of offer, unless asked by BHEL, shall not be considered. With-drawl of quotation by the bidder, at any stage after its opening, may entail blacklisting of vendor. 8. Authorized signatory should authenticate tender documents.
2.	**PRICES:** **A. The prices to be quoted are with PVC with following formula.** $P_1 = P_0 \times \{0.85 + 0.15 (A_1/A_0)\} - P_0 + (M_1 - M_0)$ Where, P_1 = Price adjustment amount per kilometer of cable (if it works out negative, that would mean the amount to be recovered by the owner from the contractor) P_0 = Ex-works price per kilometer of cable. A = PVC compound: Price of Grade CW-22, as published by IEEMA. M_1-M_0 = Change in metal components of the ex-works price of particular type and size of cable. M = Weight in MT of metal per km of cable X published price index of metal per MT as published by IEEMA. Published price Index for metal: i) For Aluminium: **Price of LME Average Settlement Price including Premium for Ingot, as published by IEEMA.**

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ii) For Copper: Price of copper wire rods, as published by IEEMA.

Weight in MT of metal per km of cable and price index of metal per MT: As per IEEMA Circulars.

Subscript `0` refers to base indices as on 30 days prior to date of bid opening. The base indices in the formula shall be of first notification of IEEMA of the **JAN'' 2015** month.

Subscript `1` refers to indices as applicable on 60 (sixty) days prior to the date of shipment.

The date of delivery shall be PO delivery date or date of actual despatch, whichever is earlier.

The total adjustment shall be subject to a ceiling of ± 20% (plus or minus twenty percent).

B. The prices shall be quoted by the vendors considering following

The prices are to be quoted on **FOR** (Destination) basis. The break-up of price shall be as under:-

a) Ex-works Price: Ex- works price including packing & forwarding charges.

b) Excise duty: ED exempted against PAC (Project Authority Certificate by RRVUNL) and Mega Power Certificate issued by GOI .

c) Sales Tax: ST / VAT / CST (against C-form) to be quoted as percentage in un-price and price bid. In case of interstate sale-in-transit supplier have to provide E1/E2 form.

d) Entry tax / Octroi Charges: Any Entry tax / Octroi applicable at destination / destination state shall be paid extra on proof of such payment.

e) Freight & Insurance: Freight and Transit Insurance for door delivery up to destination/store is to be quoted.

f) Type Test charges: As per technical specification enclosed with this Enquiry.

Note: i) The purchase order shall be placed on Ex – Works basis.

"BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue."

(Further to above clause, please refer attached Annexure I for Terms & Conditions Of Reverse Auction Page 1 & 2)

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3.	**TERMS OF PAYMENT:** 100 % Payment with Taxes, Duties, Freight & Insurance within 60 days (**45 Days for MSE vendor**) from the date of receipt of complete invoice with following documents in 3 sets (Original + 2 copies): - LR duly endorsed in the name of customer by BHEL site - Receipt of material on the attached format by BHEL site - Excise invoice (If Applicable) - Delivery Challan or Packing list (case wise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers - MICC - Guarantee Certificate - Copy of Performance Bank Guarantee. [A.] Documents to be furnished by vendor immediately after dispatch: - Copy of Invoice - Copy of LR - Copy of Delivery Challan / Packing List - Copy of Insurance Certificate - Copy of Guarantee Certificate [B.] Following Documents to be sent by vendor to TBG, BHEL : - LR duly endorsed in the name of customer by BHEL site - Receipt of material on the attached format by BHEL site - Excise invoice (If Applicable) - Delivery Challan / Packing list (case wise) - Transit insurance certificate from under writers or Copy of Intimation of Transit Insurance duly endorsed by under writers - Dispatch Clearance / MICC - Guarantee certificate - All Test & Inspection Reports
4.	**INTEREST LIABILITY:** In case of any delay in payment due to any reason, BHEL shall not pay any interest on delayed payment.
5.	**GUARANTEE :** The equipment / material shall be guaranteed for 18 months from the date of delivery or 12 months from the date of commissioning, which ever is earlier. The defective material / component shall be replaced free of cost at site.
6.	**PERFORMANCE BANK GUARANTEE:** Bidder shall furnish along with first invoice Performance BG / deposit as per follows. **Option A** BG for 10% of the total Ex-works PO value, valid for 18 months + 3 months claim period (i. e. total 21 months) from the date of last delivery. **Option 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 24 months from the date of first delivery. The Bank guarantee shall be from State Bank of India / State bank of Hyderabad / State Bank of Travancore / State Bank of Mysore / Canara Bank / Bank of Baroda / Punjab National Bank / Deutsche Bank / HDFC Bank / Standard Chartered Bank / CITI Bank / ICICI Bank / IDBI Bank / HSBC / any other Nationalised Bank. The

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	original BG should be sent by issuing Bank directly to AGM (Finance), TBG, BHEL. All the bank Guarantee shall be from a schedule bank In India acceptable to BHEL. The original BG should be sent by issuing bank directly to AGM (Finance) TBG BHEL. BANK Guarantee should be valid for lodging claim within two month after expiry of guarantee period. **If no option is specified, by default option – A shall be considered for confirmation.**
7.	**FINAL ENGINEERING DOCUMENTATION:** Final documentation as called in the specification is to be submitted within 3 months from the date of despatch of material. In case of default, the Performance BG is liable to be en-cashed.
8.	**INSPECTION:** BHEL and / or customer / third party may inspect the Equipment / Material before despatch. In the event BHEL / Customer waives off inspection, Test Reports and Results shall be submitted for Approval. Supplier shall obtain Approval on Test Reports and MDCC / MICC (Material Inspection Clearance Certificate) before dispatch of equipment. Stage inspection during manufacturing may also be carried out. Material to be dispatched only after getting Dispatch Clearance from BHEL. **Supplier shall send inspection call on prescribed format only, with an advance notice of 15 days. (New Format of Inspection Call attached with this Enquiry).**
9.	**DESPATCH DOCUMENTS:** Following despatch documents are to be immediately sent to purchaser on despatch. - Copy of Invoice - Copy of LR - Copy of Delivery Challan / Packing List - Copy of Insurance Certificate - Copy of Guarantee Certificate
10.	**DELIVERY PERIOD:** Bidder to specify the delivery period in weeks from the date of PO in the Activity Schedule Format enclosed with enquiry. Time for conduction of type test, if required, is to be separately indicated. Note: LR date or Invoice date whichever is later shall be considered as delivery date.
11.	**DELAYED DELIVERY:** In case of delay in execution of order beyond the lot wise contractual delivery, an amount of ½ % of total Ex-Works Value per week or part there-of subject to **maximum of 10% of total Ex-Works value** of P.O. will be withheld.
12.	**VALIDITY:** The offer shall be valid for 120 days from the due date of opening.
13.	**ACCEPTANCE / REJECTION OF TENDER:** BHEL reserves the right to reject in full or part, any or all tender without assigning any reason thereof. BHEL also reserves right to vary the quantities mentioned in the tender.
14.	**EVALUATION: Comparative statement shall be prepared based on overall quantity basis unless otherwise indicated in the enquiry. Evaluation of offers shall be done on the basis of delivered cost to BHEL.**
15.	**DEVIATION:** The bids having deviation(s) w.r.to tender are liable for rejection. However, BHEL, at its discretion, may **load the prices for evaluation of offer as mentioned at Sl. No. - 24.**
16.	**ARBITRATION:** All cases of disputes emanating from and relating to this contract shall be referred to the sole arbitrator appointed by Unit Head / GM, BHEL. The arbitrator may be an 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

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	arbitrator shall give a reasoned award. The decision of the arbitrator shall be final & binding upon both the parties. The venue of arbitration shall be Delhi.
17.	**LEGAL SETTLEMENT:** All disputes shall be subject to jurisdiction of court situated in Delhi/New Delhi only. Notwithstanding contained herein anything in this NIT, the original exclusive jurisdiction shall remain of the court at Delhi / New Delhi.
18.	**SUBCONTRACTING:** In case further subcontracting of BHEL order or part thereof is envisaged by supplier, the same can be done after written permission is obtained from BHEL. However it shall not absolve the supplier of the responsibility of fulfilling BHEL purchase order requirements.
19.	**RISK PURCHASE:** In case the successful bidder fails to supply or fails to comply with the terms & conditions of the purchase order, BHEL reserves the right to source such material/ component / equipment/ system from any other agency at the risk and cost of the successful bidder.
20.	**ADJUSTMENT OF RECOVERY:** Any amount payable by the supplier under any of the condition of this contract shall be liable to be adjusted against any amount payable to the supplier under any other works/contract awarded to him by any BHEL unit. This is without prejudice to any other action as may be deemed fit by BHEL.
21.	**FORCE MAJEURE CONDITION:** 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 fulfilment of contract and shall not be held responsible for non performance in such circumstances.
22.	**DEMURRAGE / WHARFAGE:** For the reasons of delay in receipt of documents from suppliers or due to the same being found to be incomplete, and/or faulty, the suppliers shall be responsible to reimburse in all demurrages / wharfages, if any, paid by BHEL (for stated reasons).
23.	**SPECIAL CONDITION:** Procurement will be from manufacturers only. Manufacturers should submit offers directly. However in case of involvement of any representative the details of the same along with the copy of the agreement should be submitted in the first part of the offer. Principal manufactures must ensure that the nominated representative do not represent any other manufacture for the same item.
24.	**LOADING CRITERIA FOR DEVIATIONS TAKEN BY BIDDER ON:** 24.1 : TERMS OF PAYMENT: If a bidder asks for payment within specified no. of days from the date of receipt of invoice with complete documents as per "Terms of Payment" at sr. No. 3 above, loading to be done as follows: a) Base rate of SBI (as applicable on the date of techno commercial bid opening) + 6 % shall be considered for loading for the period of relaxation sought by the bidder. b) 60 days - No loading 24.2 : DELAYED DELIVERY / PENALITY DUE TO DELAYED DELIVERY: Loading for not accepting this clause / accepting only on un delivered portion shall be the maximum amount specified in this clause. 24.3 GUARANTEE: Normally BHEL may not accept deviation against this clause and offer may be ignored on this deviation, however If the offered guarantee period

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	is less than the tender guarantee period the ex- works prices shall be loaded for the difference in the period (higher of the difference with respect to guarantee required from date of delivery and date of commissioning) @ 2.5 % per year for number of months(fractional months to be rounded off to next higher)
25.	"MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM II certificate having deemed validity (five years from the date of issue of acknowledgement in EM II) or valid NSIC certificate or EM II certificate along with attested copy of a CA certificate (Format enclosed at Annexure -1 where deemed validity of EM II certificate of five years has expired) applicable for the relevant financial year (latest audited). Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of their bid at par with other bidders. No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazetted officer. "
26.	**Pre Qualification Criteria:** Only Indigenous vendor to participate in this Enquiry. 1. The bidder should be a manufacturer of 1.1 kV Auxiliary Power & Control Cables. 2. The bidder should have a minimum experience of **Two Years as on 03/12/2012** for supply of 1.1 kV Auxiliary Power & Control Cables. 3. **Applicable for PVC control cable** The bidder should have supplied in a single contract at least 100 kms of 1.1 kV grade PVC insulated control cables **as on 03/12/2012**. Further the bidder should also have supplied at least 1 km of 19C x 2.5 sq. mm. or higher size 1.1 kV grade PVC insulated control cables **as on 03/12/2012**. **Applicable for XLPE power cable** The bidder should have supplied in a single contract at least 20 kms of 1.1 kV grade XLPE insulated power cables **as on 03/12/2012**. Further the bidder should also have supplied at least 1 km of 3.5C x 300 sq. mm. or higher size 1.1 kV grade XLPE insulated power cables **as on 03/12/2012**." The Bidder must ensure that they confirm the Pre Qualification Criteria and the necessary documentation in this regard would be provided by Bidder to BHEL along with their offer for ascertaining that they confirm the Pre Qualification Criteria. BHEL Reserves the Right to reject any offer from Bidder in case of Non – Compliance to the Pre Qualification Criteria or inability of Bidder to produce the necessary documentation for ascertaining that they confirm the Pre Qualification Criteria.

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27.	**Inspection & Testing (Indigeneous / offshore) :** Cost towards the inspection of equipment by owner / consulting Engineer or inspector will be to vendor's account which will include to and fro Airfare / Railway / Road fare charges, boarding and lodging, local transportation and other related expenses. The cost shall be included in the price.

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.

SCHEDULE OF PRICE

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

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

TENDER ENQUIRY NO. : 224E220 dated 6.2.2015

SL. NO.	DESCRIPTION OF ITEM	UNIT	QTY.	UNIT PRICE EX. WORKS (Rs.)	TOTAL EX. WORKS (Rs.) (5 * 4)	UNIT FREIGHT & INSURANCE (Rs.)	TOTAL Freight & insurance (Inclusive of Service Tax, if any) (Rs.) (7 * 4)	ED @ .....% OF OF COL 6	CST / ST @ ...% OF COL 6+9 (6 + 9)	TOTAL F.O.R. DESTINATION PRICE (Rs.) (6+8+9+10)	M-FACTOR (FOR PVC CALCULATION)
1	2	3	4	5	6	7	8	9	10	11	12
1	2C x 2.5 sq mm PVC/Copper, Armoured Control cable	kM	4								
2	5C x 2.5 sq mm PVC/Copper, Armoured Control cable	kM	36								
3	7C x 2.5 sq mm PVC/Copper, Armoured Control cable	kM	19.5								
4	10C x 2.5 sq mm PVC/Copper, Armoured Control cable	kM	104.5								
5	14C x 2.5 sq mm PVC/Copper, Armoured Control cable	kM	33								
6	19C x 2.5 sq mm PVC/Copper, Armoured Control cable	kM	29.5								
7	2C x 6 sq mm XLPE/Aluminium, Armoured Aux. Power cable	kM	4.5								
8	4C x 6 sq mm XLPE/Aluminium, Armoured Aux. Power cable	kM	5								
9	4C x 16 sq mm XLPE/Aluminium, Armoured Aux. Power cable	kM	6								
10	3.5C x 35 sq mm XLPE/Aluminium, Armoured Aux Power cable	kM	8								
11	3.5C x 70 sq mm XLPE/Aluminium, Armoured Aux Power cable	kM	9								
12	3.5C x 95 sq mm XLPE/Aluminium, Armoured Aux Power cable	kM	1.5								
13	3.5C x 300 sq mm XLPE/Aluminium, Armoured Aux. Power cable	kM	2								
14	1C x 10 sq mm XLPE/Aluminium, Armoured Aux. Power cable	kM	9								
15	1C x 150 sq mm XLPE/Aluminium, Armoured Aux. Power cable	kM	2.1								
16	1C x 150 sq mm Elastomer Rubber/Copper, Armoured Fire Survival cable	kM	2.1								
17	10C x 2.5 sq mm Elastomer Rubber/Copper, Armoured Fire Survival cable	kM	3								
	TOTAL PRICE										

Rate of Service Tax applicable on F&I, if any .....% (If nothing is specified, by default it shall be considered as NIL)

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

"X" THE MAXIMUM ED SLAB RATE BE CONSIDERED FOR PRICE COMPARISON. IN THE EVENT OF ORDER ED AT ACTUAL BE PAID.

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

SIGNATURE & SEAL OF TENDERER

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESSS GROUP
MATERIAL RECEIPT CERTIFICATE

Date: _____

a) Site Name :
b) Site Address:
c) PO No. with date:
d) Supplier Name:
e) Invoice no. with date:
f) LR No with date:
g) Transporter Name:
h) Vehicle No.:
i) Date of receipt of material at site:
j) Destination: From _____ To _____
k) Material details (as mentioned below):

S.No	Item Description	Type of Packages	Unit (MT/KM/ NO.)	Qty as per packing list	Qty Received	Qty Accepted	Remarks
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							

Other Remarks:

Signature with date: _____
Name & Designation: _____
(With Seal)

TRANSMISSION BUSSINESS GROUP
MATERIAL MANGEMENT
BHEL, NOIDA

ACTIVITY SCHEDULE

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

ENQUIRY NO. 224E220 Dated: 06.02.2015

PROJECT: RRVUNL SURATGARH

ITEM: 1.1 kV AUXILIARY POWER & CONTROL CABLE

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 etc.		Documents complete in all respect are to be Submitted. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier
4.	Review and Approval of documents and issue of manufacturing clearance	BHEL ACTIVITY	Vendor must ensure to reply all queries expeditiously.
5.	Manufacturing Time		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

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. Vendors to quote their Best Delivery Plan.

SIGNATURE AND SEAL

ENQUIRY NO. 224E220 Dated: 06.02.2015

SCHEDULE OF COMMERCIAL DEVIATION

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

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

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

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

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

Place ……..

Date ……..

Signature of the authorized representative of

Bidder's Name …….

Designation ……..

Company seal …….

ENQUIRY NO. 224E220 Dated: 06.02.2015

SCHEDULE OF TECHNICAL DEVIATION

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

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

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

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

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

Place ……..

Date ……..

Signature of the authorized representative of

Bidder's Name ……

Designation ……..

Company seal …….

ENQUIRY NO. 224E220 Dated: 06.02.2015

CHECKLIST

SCHEDULE OF INFORMATION TO BE FURNISHED WITH THE OFFER

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

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

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

The above checklist is verified for:-

Offer Ref. :

Equipment :

Submitted by : M/s

Project Reference. :

Signed with Seal ……..

Date ……..

Annexure - I

Certificate by Chartered Accountant on letter head

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

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

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

(Strike off whichever is not applicable)

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

Or

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

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant

INSPECTION REQUEST

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

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

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

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

Signature
Name :
Contact No. :
Date :

Distribution :

1. Material Management , BHEL, New Delhi

Note :

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

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

PROFORMA FOR SECURITY-CUM-PERFORMANCE GUARANTEE

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

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

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

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

NOW THIS DEED WITNESSES AS FOLLOWS :

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

(Contd....2.)

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

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

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

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

   The Guarantor undertake not to revote 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.

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-360-510-018	Rev 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECIFICATION	NAME	RD	VK	RS
TITLE		SIGN			
		DATE	08/01/15	12/1/15	13/1/15
1.1 kV Aux Power & Control Cables		GROUP	TBEM	W.O. No	83001

CUSTOMER	RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD
CONSULTANT	TATA CONSULTING ENGINEERS LTD (TCE)
PROJECT	400kV SWITCHYARD AT 2 X 660 MW SURATGARH SUPER-CRITICAL THERMAL POWER STATION, STAGE-V, UNIT-7 & 8

CONTENTS

Rev No.	Date	Altered	Checked	Approved	REVISION DETAILS

Distribution	To Copies	TBTS	O/C	TBMM	TBQM	TBCM
		-	1	-	-	1

SECTION 1
SCOPE, SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

1.0 SCOPE

This Specification covers the requirements of design, manufacture, testing at manufacturer's Works, packing, supply, delivery at site of 1.1 kV Aux Power & Control Cables as listed under this specification. This section covers the specific technical requirements of 1.1 kV Aux Power & Control Cables. This constitutes minimum technical parameters for the above item as specified by the customer (RRVUNL/TCE). The offered equipment shall also comply with the General Specification for the project as detailed under section-3 of this specification.

In case of any conflict between the technical details mentioned in this section and the remaining sections of this document, then Section-1 shall prevail and is to be considered as binding requirement.

The specification comprise of following sections:

Section-1:	Scope, Specific Technical Requirements and Quantities.
Section-2:	Equipment Specification.
Section-3:	Project Details and General Technical Requirements.
Section-4:	Checklist.

Note: The term 'Owner' appearing in this specification shall refer to RRVUNL/TCE, the term 'Purchaser' shall refer to BHEL and the term 'Contractor' shall refer to the successful Bidder.

1.1 THE EQUIPMENT IS REQUIRED FOR THE FOLLOWING PROJECT

Name of customer: Rajasthan Rajya Vidyut Utpadan Nigam Ltd (RRVUNL)

Name of Consultant: Tata Consulting Engineers Ltd (TCE)

Name of of the project: 400kV Switchyard at 2x660 MW Suratgarh Super-Critical Thermal Power Station, Stage-V, Unit-7 & 8

Refer Section - 3 for Project Details and General Specifications.

1.2 SPECIFIC TECHNICAL REQUIREMENTS

1.2.1 As per Annexure-1 (RRVUNL/TCE specification, 19 pages).

1.2.2 (a) **Strip armouring method (a) mentioned in Table 5, Page-6 of IS: 1554 (Part 1) - 1988 shall not be accepted for any of the cables.**

(b) **Strip armouring method (a) mentioned in Table 6, Page-6 of IS: 7098 (Part 1) - 1988 shall not be accepted for any of the cables.**

1.3 QUANTITIES

Sl. No.	Type of Control Cables	Quantity (kM)		
		400 kV Switchyard at Suratgarh Unit-7&8	400 kV Existing Switchyard at Suratgarh Unit-5&6	Total
1.1	2C x 2.5 sq mm PVC/Copper, Armoured	3.5	0.5	**4.0**
1.2	5C x 2.5 sq mm PVC/Copper, Armoured	32.0	4.0	**36.0**
1.3	7C x 2.5 sq mm PVC/Copper, Armoured	17.5	2.0	**19.5**
1.4	10C x 2.5sqmm PVC/Copper, Armoured	97.5	7.0	**104.5**
1.5	14C x 2.5 sq mm PVC/Copper, Armoured	30.0	3.0	**33.0**
1.6	19C x 2.5 sq mm PVC/Copper, Armoured	26.5	3.0	**29.5**
	Type of Aux Power Cables			
2.1	2C x 6 sq mm XLPE/Aluminium, Armoured	4.0	0.5	**4.5**
2.2	4C x 6 sq mm XLPE/Aluminium, Armoured	4.5	0.5	**5.0**
2.3	4C x 16 sq mm XLPE/Aluminium, Armoured	5.5	0.5	**6.0**
2.4	3.5C x 35 sq mm XLPE/Aluminium, Armoured	7.5	0.5	**8.0**
2.5	3.5C x 70 sq mm XLPE/Aluminium, Armoured	9.0	0	**9.0**
2.6	3.5C x 95 sq mm XLPE/Aluminium, Armoured	1.0	0.5	**1.5**
2.7	3.5C x 300 sq mm XLPE/Aluminium, Armoured	2.0	0	**2.0**
2.8	1C x 10 sq mm XLPE/Aluminium, Armoured	8.5	0.5	**9.0**
*2.9	1C x 150 sq mm XLPE/Aluminium, Armoured	1.9	0.2	**2.1**
	Type of Screened Control Cables			
3.1	4P x 0.5 sq mm PVC/Copper, Armoured	5.5	0	**5.5**
	Type of Fire Survival Cables			
*4.1	1C x 150 sq mm Elastomer Rubber/Copper, Armoured Fire Survival Cable	1.9	0.2	**2.1**
4.2	10C x 2.5 sq mm Elastomer Rubber/Copper, Armoured Fire Survival Cable	3.0	0	**3.0**

Note:

1) The above quantities are tentative and the length of total cables procured may be subject to a change of -10% to +30% before the placement of order. Quantity variation on the total ordered cables shall be ±10% at contract stage.

2) Some of the cable types may not be ordered at all at contract stage.

3) Cut lengths for cables marked as (*) shall be informed during detailed engineering stage. Out of the cable types mentioned in Sl. No. 2.9 and 4.1 above, any one type of cable shall be ordered.

All Control and Power Cables shall be supplied in drum length of 1000 m, unless otherwise specified. For power cable with conductor cross sectional area 300sqmm and above may be supplied in 500m drums. Owner shall have the option of rejecting cable drums with shorter lengths. The cable length per drum is allowed a tolerance of ±5%. However, the total quantity of cables after taking into consideration of all cable drums for each size shall be within the tolerance of ±2%.

1.4 TESTS

Cables shall conform to type tests including additional type tests as per technical specification and shall be subject to routine & acceptance tests in accordance with requirements stipulated under respective sections.

The reports for all type tests and additional type tests as per technical specification shall be furnished by the bidder along with equipment / material drawings.

The bidder will conduct the routine tests on each drum length. All the type and acceptance tests shall be conducted as per specification and relevant standards/ approved MQP. These tests will be witnessed by owner/purchaser/purchaser's representatives.

The prices for conducting all tests as per Cl. No. 2.3, 2.4 and 12.0 of Annexure-1, Section-1 are deemed to be included in respective cable prices.

1.5 QUALITY PLAN

The manufacturer shall carry out contract works in accordance with sound quality management principles which shall include items such as controls which are necessary to ensure full compliance to all requirements of the specification & applicable international standards. These quality management requirement shall apply to all activities during design, procurement, manufacturing, inspection, testing, packaging, shipping, inland transportation, storage, site erection & commissioning. Manufacturer shall submit detailed Quality Plan for BHEL / customer's approval.

ANNEXURE-1

[redacted]

CABLES AND CABLE CARRIER SYSTEM

1.0 CABLES

1.1 H T POWER CABLES

System cables shall be 11kV (UE) and 6.6 kV (UE) grade suitable for use in medium resistance earthed system, stranded & compacted aluminium conductor, extruded semi conducting screen over conductor, XLPE insulated, semi-conducting followed by copper tape screened, extruded PVC Type ST – 2 inner sheathed, aluminium/GS wire armoured, overall FRLS PVC outer sheathed, conforming to IS 7098 (Part II), IEC-502 for constructional details and tests.

1.2 L T POWER CABLES

LV Power Cables shall be 1100 V grade, single / multi core, stranded aluminium conductor, XLPE insulated, with PVC inner sheath, armoured and outer sheath made of FRLS PVC compound generally conforming to IS 7098 (for XLPE). The cables used for DC system shall be of single core type. Minimum conductor cross section of power cables shall be 6-sq. mm for aluminium cables.

1.3 CONTROL CABLES

Control cables shall be 1100 V grade, multi core, minimum 1.5 sq. mm cross section, stranded copper conductor having minimum 7 strands, PVC insulated, PVC inner sheathed / galvanised steel wire armoured, overall FRLS PVC outer sheathed generally conforming to IS 1554 Part-I. In situations where accuracy of measurement or voltage drop in control circuit warrants, higher cross sections as required shall be used.

1.4 INSTRUMENTATION CABLES

The instrumentation cables shall be Annealed, tinned stranded copper conductor, 0.5 sq mm , twisted into pairs, ~~overall screened (I1 type) for digital signals~~, individual and overall screened (for I2 type) for low level analog signals, individual triplet and overall screened (type I3), PVC insulated , inner PVC sheathed, GS wire armoured and overall sheathed with FRLS PVC. The insulation shall be strippable manually as well as by mechanical stripping devices without damage to the conductor.

1.5 TRAILING POWER AND CONTROL CABLES FOR MOBILE EQUIPMENT.

11 kV(UE) and 6.6 kV (UE) and 1100V-(E) grade power & control flexible trailing, annealed tinned copper conductor, EPR insulated, EPR inner sheathed, CSP outer sheathed and shall have conductor screen of rubber. Cables shall conform to IS requirements and any other applicable standards.

1.6 FIRE SURVIVAL CABLES

1.6.1 Power and control, single/multi, stranded copper conductor fire survival cables complying with IEC-60331 shall be provided for following systems as per CEA guidelines.

(a) DC emergency lube oil pumps

(b) DC seal oil pumps

(c) DC emergency lighting cables for main building

(d) Batteries to chargers and DC distribution boards

(e) Turbine lube oil pumps

(f) Jacking oil pumps

(g) Emergency turbine trip by pushbutton in control room

(h) Boiler Turbine: Generator inter trip which includes the interconnecting cables between:

- Boiler master fuel trip and turbine trip relays
- Generator trip relays and turbine trip relays
- Generator trip relays and 400kV breakers
- Generator trip relays and generator field breakers
- Generator trip relays and ST and UT breakers

1.6.2 FS cables shall have following properties:

(a) Excellent fire resistance characteristics

(b) Cables shall have features of nontoxic and low smoke generation

(c) Flame non-propogation property

(d) Ability to withstand burning & continue to function during and after fire

(e) Low smoke emission & low halogen property to maintain circuit integrity to essential services under severe fire condition.

1.6.3 Construction of FS cables

(a) Conductor- Copper stranded

(b) Fire proof layer- heat barrier based

(c) Insulation- elastomer rubber

(d) Fire proof layer- same as 2 above but optional – natural or synthetic, fibre or elastomer

(e) Filler- suitable filler optional

(f) Binder tape – two layers of glass fibre tape

(g) Inner sheath- HOFR FRLS elastomer (heat & oil flame retardant)

(h) Armouring/screening – suitable wire

(i) Over all sheath – HOFR FRLS

1.7 Cables for the fire detection and alarm system and communication system shall be as described else where.

2.0 CABLE PROPERTIES

2.1 All single core power cables shall have wire / strip armouring of aluminium, whereas multi core power cable shall have galvanised steel wire / strip armouring.

2.2 The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack.

2.3 The outer sheath of FRLS PVC compound shall meet the following performance requirements:

(a) The critical oxygen index value shall be minimum 29 when tested at 27± 2°C as per ASTM-D-2863-77 and the temperature index shall be minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863.

(b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994). Halogen acid content in outer sheath in FS cables shall not be more than 2%.

(c) Flammability

(i) Cables shall pass tests under fire condition as per IS-10810-Part-53.

(ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.

(iii) Fire survival cables in addition to tests (i) and (ii) above shall pass tests as per IEC-331.

(d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977). Smoke density in FS cables shall not exceed 20%.

(e) The cables shall pass the ultraviolet tests as per DIN 53387.

(f) The cables shall pass the tests for Water absorption tests as per IS 10810.

2.4 The finished cable shall pass the flammability test as per IEC-322-1 (1993) and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475 (1977).

2.5 ~~In addition, cables for devices mounted on or near hot surfaces of Steam Generators, Turbine Generators, Main steam etc shall have heat resistance type outer sheath.~~

2.6 All LT cable shall have embossing at interval of 1 meter for owner name, size/ core type and length.

2.7 All cables shall be embossed with the name of RVUNL in addition to what is specified in the standards.

3.0 DESIGN CRITERIA FOR CABLE SIZING

3.1 POWER CABLES

Power cable sizes shall be selected on the following basis:

3.1.1 Power cables shall carry the full load current of the circuit continuously under site conditions considering the condition listed below:-

(a) Ambient design temperature 50 deg. C.

(b) Maximum allowable temperature under normal full load condition and under short circuit condition based on material selected (XLPE).

(c) Maximum short circuit fault current.

(d) Ambient temperature for underground cables, 50 deg. C.

(e) De-rating factors as per IS/IEC and manufacturer's standard catalogues.

3.1.2 Power cables shall withstand the fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault. Fault clearing times for ties between two 6.6 kV switchgears shall be considered as 1 sec. Fault clearing times for ties between two 415V switchgears shall be considered as 0.5 sec.

3.1.3 For the cables to 415 V motors and feeders protected by fuses, the cross section shall be chosen according to the cut-off current of the fuse and its fusing time.

3.1.4 Voltage drop from transformer secondary to motor terminals during starting of motors will be limited to the following values:

(a) For HV motors (except MDBFP motor) – 15% of the rated voltage

(b) For MDBFP motors – 20% of the rated voltage

(c) For LV motors – 15% of the rated voltage.

3.1.5 Voltage drop in feeder cables shall be limited to 3% during full load running condition. Voltage drop from transformer secondary to motor terminals during full load running of motors shall be limited to 5 % of rated voltage.

3.1.6 For power supply to valve actuator motors, actuators of various isolating and regulating dampers and exhaust fans, 3 core 2.5 sq. mm stranded copper conductor cable may be used in view of ease of termination. These cables shall be in other respects similar to cables described in Clause 1.2 above.

3.1.7 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.

3.1.8 DC System Cables:-

3.1.8.1 1100 V grade, single core cables as specified in LT power cables shall be used from batteries/ battery chargers to main DCDB, between main Distribution Board, from main Distribution Board to sub distribution board, main DC supply to various system cabinets/panels, Switchgears etc and for critical auxiliaries. Flexible cables with PVC insulation shall be used where termination of XLPE/PVC insulated cables is difficult.

3.1.8.2 Voltage drop in cables between battery to DCDB and battery charger to DCDB shall be limited to 2%. Voltage drop in cables between DCDB and loads shall be limited to 3%.

3.1.8.3 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.

3.2 CONTROL CABLES

3.2.1 Current transformer leads shall be checked for the lead burden vis-a-vis the current transformer VA capacity. In case 2.5 sq. mm conductor impose unacceptably high burden on CTs, 4.0-sq. mm conductor shall be used. The conductor material shall be copper.

3.2.2 Voltage transformer leads shall be checked for voltage drop which shall be limited to within 1% for all cases other than tariff metering. For tariff metering the voltage drop shall be limited to 0.2%. In case the voltage drop with 2.5 sq. mm conductors exceed this value, higher conductor sizes shall be used.

3.3 INSTRUMENTATION CABLE

3.3.1	Element identification	:	As per IEC-60189-2
3.3.2	Core wrapping	:	By non-hygroscopic material by taping or by extrusion
3.3.3	Element screening	:	By copper tape of minimum 0.04mm thickness or by copper laminated plastic tape
3.3.4	Rip cord	:	Non-metallic rip cord under the core wrapping
3.3.5	Drain wire	:	A tinned copper drain wire of minimum 0.05 mm^2 cross section in contact with each screen of cabling element.

Cabling elements shall be any one of the following:

A 'Pair' of two insulated conductors twisted together designated by alphabet 'p' printed on a binding tape at 200 mm intervals.

A 'Triple' of three insulated conductors twisted together designated by alphabet 't', printed on a binding tape at 200 mm intervals.

Maximum length of lay in the finished cable shall be 120 mm.

3.3.6 Units

Cables shall be bunched together in units of twenty cabling elements or sub units of five or ten elements, stranded in concentric layers. The units or sub

units shall be designated by p1, p2, p3,. t1, t2, t3..,q1, q2, q3, .., or Q1, Q2, Q3 ..., etc. depending on the combination.

3.3.7 Overall screening and armouring

Cables shall have an overall screen made up of copper/aluminium tape of 0.04 mm thickness or copper/aluminium of 0.008 mm thickness laminated with plastic tape with a minimum overlap of 15%.A drain wire of tinned copper with minimum 0.5 mm^2 cross section shall be provided in continuous contact with the screen.

3.3.8 Inner and Outer Sheath

The inner and outer sheaths shall consist of black PVC compound.

3.3.9 Insulation Resistance

Minimum insulation resistance per km shall be 500 mega Ohm.

3.3.10 Mutual Capacitance

Mutual capacitance of any pair of conductors shall not exceed 120 nF/km.

3.3.11 Capacitance Unbalance

The capacitance unbalance between any two pairs shall not exceed 400 pF for 500 metre length of cable.The construction, performance and testing of cables except as mentioned above shall generally comply with the following standards :

IEC-60189 - Part-1 : Low frequency cables and wires with PVC insulation and sheath. General test and measuring methods

IEC-60189 - Part-2: (-do- Cables in pairs and triples).

4.0 CABLE TERMINATIONS

4.1 Cables shall be laid in trays /trenches/ conduits by the Bidder. Also joint markers shall be provided at each joint.

4.2 All 1100V termination for XLPE/PVC power cables and control cables shall be by Double compression weather proof type cable glands. Heavy duty, tinned, long barrel copper lugs shall be used for termination.

5.0 CABLE JOINTS

Cable joints shall be avoided to the extent possible. If joints are unavoidable due to circuit length, in excess of permissible maximum drum length, they shall be heat shrinkable types having a short circuit with stand capacity value as specified in clause 3.1.2 above. Lugs shall be heavy duty, tinned copper, long barrel type. All cable glands shall be double compression, weather proof.

6.0 POWER RECEPTACLES

3 phase, 5 pin, 63A power receptacles with switch shall be provided . The receptacle shall be industrial heavy duty type and shall have suitable interlock facility for safety. The receptacle shall conform to IS 1293 and the switch to IS 4064.

7.0 CABLE CARRIER SYSTEM

7.1 The cable carrier system shall be designed considering the following :

(a) Facility for easy laying of cables.

(b) Access to maintenance.

(c) Neat and aesthetic appearance.

(d) Safety of equipment & personnel.

(e) Ground water seepage.

(f) Drainage system for oil and water.

7.2 Cables shall be laid in prefabricated ladder (for power and control) / perforated (instrumentation) type trays and in conduits. Also joint markers shall be provided at each joint. The cable trays shall be laid vertical in boiler and ESP area, coal handling and ash handling area.

7.3 Cable trays and supporting structures in chemically corrosive area like battery room and water treatment plant shall be mild steel painted trays finished with chlorinated rubber based paint/epoxy paint.

7.4 Cable trenches will be avoided to the extent possible inside Fuel oil pump house, water treatment plan where possibility of oil and water collection exists and Boiler & ESP areas.

7.5 No direct underground burial cables shall be laid except lighting tower, street lighting. For some exceptional case like isolated individual equipments it shall be allowed after approval by the owner /consultant.

8.0 CABLE INSTALLATION AND ACCESSORIES

8.1 All material and accessories required for cable installation like cable trays, tray covers, support steel, etc., shall be hot dip galvanized. Conduits/pipes shall also be hot dip galvanized steel. The racks/trays, conduits/pipes, trenches required to route the cables to individual equipment shall be supplied and installed by the BIDDER.

8.2 Separate trays shall be provided for LV Power (AC&DC)/Control & Instrumentation cables.

8.3 After laying all the cables, BIDDER shall dress all cables by clamping at every metre, so that the cables are securely held and aesthetically good.

8.4 Cable trays shall be avoided very close to the pipes carrying high temperature steam. When they are inevitable, it shall be laid after OWNER approval and

suitable insulation material shall be provided between the cable trays and pipes.

8.5 1100 V cables up to 120-sq. mm. can be laid in two layers. Control and Instrumentation cables can be laid in three layers.

8.6 One spare conduit shall be provided for cable of center / outer drive in clarifier.

8.7 Power and control cables for critical / emergency drives / equipment like DC EOP / JOP shall be kept away and routed in separate cable trays

8.8 All cable entries to the buildings to be sealed by fire proof & water proof cement after cable installation.

8.9 One drum (500m) spare LT power/control of each size of cable shall be included.

9.0 CABLE TRAYS AND COVERS

9.1 All outdoor cable trays are to be provided with covers. All vertical cable tray race ways are to be provided with covers all round. Cable trays shall be of ladder / perforated type complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories. Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc., shall be fabricated from 12 gauge (2.5 mm thick) mild steel sheets. Cable tray covers shall be provided for all cable trays and raceways. The cable tray accessories like trays, elbows, bends, etc., shall be fabricated and galvanized before bringing to site. Cable tray covers shall be fabricated from 16 gauge (1.7 mm thick) MS sheets. All the sheet steel shall be hot dip galvanized.

9.2 1100 V rated cables of sizes 120-sq. mm and above shall be laid in single layer. Single core cables used for 3-phase AC power circuits shall be laid in Trefoil form with suitable PVC aluminum clamps to hold the cables.

9.3 The sizing of cable trays from TG building to other areas shall consider para 9.2 above an additionally to avoid crowding and criss crossing of cables, especially in boiler area where vertical risers are to be provided for various power, control and instrumentation cables to higher elevations of boiler.

9.4 ~~Slotted angles shall not be used for cabling. In all locations smaller size cable trays of 50 mm / 100 mm wide shall be used for one or two cables.~~

10.0 FIRE-PROOF SEALING OF CABLE PENETRATION

Cables / cable tray openings in walls and floors or through pipe sleeves from one area to another or one elevation to another, between the units and within the same unit, shall be sealed by a fire-proof sealing system. The fireproof sealing system (FPSS) shall effectively prevent the spread of fire from the flaming to the non-flaming side, in the event of a fire. The FPSS shall conform to the following requirements:

(a) FPSS shall have a fire rating of two hours.

(b) The FPSS shall be subjected to fire endurance test, hose stream test, temperature measurement of non-flaming side as per ASTM-E119. 'Standard method of fire tests of building construction and materials'.

(c) The FPSS will also conform to the in-combustibility test carried out in accordance with IS: 3144-1992.

(d) Under fire condition, the FPSS material shall not emit excessive smoke or any corrosive or toxic fumes.

(e) FPSS shall have minimum life of 25 years.

11.0 FIRE BREAK

11.1 Fire break shall be provided by applying a suitable fire-resistant coating on cables for the required length to meet the fire rating of 30 minutes.

11.2 Fire break shall be provided at an interval of 15 metres in the straight portion of each of the cable tray above ground, at intervals of 30 metres in cable trenches and at 5M for all vertical trays. All cable inter section and tee offs shall be provided with firebreaks.

11.3 When pipe sleeves are provided for cables from outdoor areas to indoor areas, the pipe opening at the outdoor side shall be sealed by fire proof sealing material, which is also continuously waterproof. The indoor side of the pipe opening shall also be sealed by continuous fire proof sealing materials. The duct banks in outdoor areas also need to be sealed by water poof seals. It is necessary to explore possibility of applying waterproof coating on fireproof sealing.

12.0 TESTS

All routine tests and FRLS tests as per relevant standard shall be performed on each size of cable. If same size is supplied in different lots, inspection shall be done for each lot. If same cable is supplied by different agencies, test shall be carried out on cables supplied by each agency. These tests shall be carried out as per relevant standards as applicable.

Routine and acceptance test shall be carried out on FPSS.

Type test certificates for type tests conducted on identical design and size of the Cables shall be submitted for review. If type tests have not been done or the certificates are found to be not in order by purchaser then these type tests shall be conducted on Cables to be supplied for this project at no extra cost to Purchaser.

13.0 For technical particulars refer datasheet-A.

Sr. No.	Description	unit	Client specification
1.0	Name of manufacturer		*
2.0	Make of cable		
3.0	Conductor No. core x Size Form- circular/segmented Effective cross sectional area sq. mm		*
4.0	Whether cores identification numbers for cables with 5 cores and above to be provided		Yes
5.0	Whether incremental running lengths are marked on cable		Yes
6.0	Finished cable a) Diameter under armour in mm b) Diameter over armour in mm c) Overall diameter in mm		*
7.0	Cable drums a) Whether cable drums confirm to IS : 10417 b) Length of cables in drum & tolerance c) Weight of cable drum without cables d) Weight of cable drum with cables e) Type of end sealing		*
8.0	FRLS cables a) Critical oxygen index value at 250 deg C when tested for temperature index test as per ASTM-		Ref. Clause 2.3

Sr. No.	Description	unit	Client specification
	D-2863 b) Total acid gas generation by weight when tested as per IEC – 754-1 in % c) Percentage of light transmission under fire for assessment of smoke generation when tested as per ASTM – D – 2843-77 d) Will the cables offered against this specification pass the flammability tests as per 1) Class – F3 – Swedish standard S5-424- 1475 2) IEC 60332 – 1C 3) IEC 60331 – 1		
9.0	Maximum dielectric loss of cable per KM at normal voltage and frequency	Watt/ km	*
10.0	Short circuit capability for 1 Sec (HT & LT Power Cable)	kA rms	Minimum 40kA and 50 kA for HT and LT respectively and shall be in line with requirements of the switchgear and protection.
11.0	Maximum dielectric stress at core screen	KV/c m	*
12.0	Max. overall diameter of cables	mm	*

'*' indicated above shall be filled by BIDDER.

SPEC.NO. TCE.5750A-H-500-001	**TATA CONSULTING ENGINEERS LIMITED**	VOLUME IV «Section»:D16
PART B	**RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan** DATA SHEET B CABLES AND CABLE CARRIER SYSTEM	SHEET 1 OF 6

ENQUIRY/SPECIFICATION NO.:	BIDDER:

Sl. No.	Description	Unit	Bidder's Offer
1.0	**Cables**		
1.1	Name of manufacturer		
1.2	Conductor a) No. core x Size b) Form- circular/segmented c) Effective cross sectional area sq. mm		
1.3	Whether cores identification numbers for cables with 5 cores and above to be provided		
1.4	Whether incremental running lengths are marked on cable		
1.5	Finished cable a) Diameter under armour in mm b) Diameter over armour in mm c) Overall diameter in mm		
1.6	Cable drums a) Whether cable drums confirm to		

NOTES TO BIDDER	SIGNATURE OF BIDDER & DATE
1. ITEMS WHICH DEVIATE FROM THE SPECIFICATION SHOULD BE MARKED WITHIN ASTERISK (*) AND DETAILS TO BE GIVEN IN SCHEDULE OF DEVIATIONS. 2. THIS DATA SHEET SHALL BE FILLED UP COMPLETELY AND A COPY SHALL BE ENCLOSED WITH EACH COPY OF THE BID.	ISSUE R1

ENQUIRY/SPECIFICATION NO.:	BIDDER:

	IS : 10417 b) Length of cables in drum & tolerance c) Weight of cable drum without cables d) Weight of cable drum with cables e) Type of end sealing		
1.7	FRLS cables		
	a) Critical oxygen index value at 250 deg C when tested for temperature index test		
	b) Total acid gas generation by weight		
	c) Percentage of light transmission under fire for assessment of smoke generation		
	d) Will the cables offered against this specification pass the flammability tests		
1.8	maximum dielectric loss of cable per KM at normal voltage and frequency	Watt/km	

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SIGNATURE OF BIDDER & DATE

ISSUE R1

ENQUIRY/SPECIFICATION NO.:	BIDDER:

1.9	Short circuit capability for 1 Sec (HT & LT Power Cable)	kA rms	
1.10	Maximum dielectric stress at core screen	KV/cm	
1.11	Max. overall diameter of cables	mm	
2.0	**Cable Terminations & Joints**		
2.1	Name of manufacture		
2.2	Applicable standards		
2.3	Nominal (Ph -Ph) system voltages	kV	
2.4	AC Withstand voltage (Ph-ground)	kV	
	• Time duration	Min.	
2.5	Partial discharge at 2 Uo	pC	
2.6	Impulse withstand, 1.2 / 50 μs	kV	
2.7	Load cycle test		
a)	Each cycle – heating duration	Hrs	
b)	Temperature	deg. C	
c)	Cooling duration	Hrs	
d)	No. of cycles		

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ISSUE R1

ENQUIRY/SPECIFICATION NO.: | BIDDER:

e)	Continuous phase to ground voltage withstand	kV	
2.8	Thermal withstand short circuit current 1 sec	kA	
2.9	Dynamic short circuit withstand	kAp	
2.10	Type test report for all the tests enclosed as specified	Yes / No	
2.11	Kit Particulars		
a)	Material of the tubing / moulded party		
b)	Method of stress control		
c)	Method of environmental seal		
d)	List of items included in the kit		
	• For terminations		
	• For joints		
e)	Whether heating device included	Yes/No	
	• How many such device included	Qty	
f)	Allowable kit storage temperature	deg. C	
g)	Kit shelf life	Years	

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ENQUIRY/SPECIFICATION NO.:	BIDDER:

2.12	Cable terminations/joints instruction manual enclosed	Yes/No	
3.0	**Fire Proof Sealing System/Fire stops**		
3.1	Manufacturers name		
	Type of FPSS provided		
3.2	Duration for which the FPSS will retain its guaranteed properties (Life expectancy)	Yrs.	
3.3	Minimum shelf life of the materials used in the fire stops	Months	
3.4	Applicable standard		
3.5	Performance tests		
3.5.1	Whether type test certificates for the following tests enclosed		
	• Fire rating test	Yes/No	
	• Hose stream test	Yes/No	
4.0	**Fire Breaks**		
4.1	Manufacturers name		

NOTES TO BIDDER

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SIGNATURE OF BIDDER & DATE

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ENQUIRY/SPECIFICATION NO.:	BIDDER:

4.2	Applicable standard		
4.3	Duration for which the FPSS will retain its guaranteed properties (Life expectancy)	Yrs.	
4.4	Minimum shelf life of the materials used in the fire stops	Months	
4.5	Type test certificates of the following tests enclosed		
	• Ampacity test	Yes/No	
	• Flame test	Yes/No	
	• Water proof test	Yes/No	

NOTES TO BIDDER

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SIGNATURE OF BIDDER & DATE

TATA CONSULTING ENGINEERS LIMITED

Thermal Power Station, Jaipur Vidyut Utpadan Nigam Ltd., Rajasthan

RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

PART B

DATASHEET-C

CABLES & CABLE CARRIER SYSTEMS

SHEET 1 OF 1

DATA TO BE FURNISHED BY THE VENDOR AFTER THE AWARD OF CONTRACT

1.0 Construction details including type of material used and thickness of each material for each type of cable in a tabular form.

2.0 Instruction Manuals

2.1 Two (2) number of copies of instruction manuals, descriptive bulletins etc. shall be furnished prior to despatch of cables. The manual shall include amongst others, the following particulars.

2.2 General information.

2.3 Principal technical data.

2.4 Description of insulation, sheathing and screening. This should include data on resistance to attack by chemicals, fungus, termites, rodents, water and ultra-violent radiation.

2.5 Installation and termination instructions.

3.0 Test Certificates

2.6 Type test certificates for all types of cables included in the order and special tests on FRLS/FS cables.

4.0 Any other information specifically called for by PURCHASER or ENGINEER subsequent to order.

5.0 **DATA FOR APPROVAL**

5.1 Technical particulars of all cables, Termination kits/joints, FPSS & Fire breaks.

5.2 Cable Sizing Calculations for both HT & LT cables.

5.3 QAP for all cables.

ISSUE R1

SECTION-2

A. EQUIPMENT SPECIFICATION FOR 1.1KV AUX POWER AND CONTROL CABLES

2.0 SCOPE

This technical specification covers the requirement of design, manufacture, testing, packing and dispatch of 1.1 kV grade Auxiliary power and control cables (FRLS type). No deviation from the requirements specified in various clauses of this specification shall be allowed.

2.1 APPLICABLE STANDARDS

The auxiliary power and control cables shall conform to following latest Indian and International standards and their amendments.

IS 1554 (Part I)	PVC insulated (heavy duty) electric cables - For working voltage up to and including 1100V
IS 7098 (Part I)	XLPE insulated PVC sheathed cables - For working voltage up to and including 1100V
IS 5831	PVC insulation and sheath of electric cables.
IS 8130	Conductors for insulated electric cables and flexible cords.
IS 3975	Low Carbon Galvanized Steel Wires, Formed Wires and Tapes for Armouring of Cables - Specification
IS 10810	Method of tests for cables.
IEEE-383	Standard for type test of class IE electric cables, field splices, and connections for nuclear power generating stations.
ASTM-D2843	Standard test method for density of smoke from burning or decomposition of plastics.
ASTM-D2863	Standard test method for measuring minimum oxygen concentration to support candle - like combustion of plastics (oxygen index).
IEC: 60754 (Part-1 & 2)	Test on gases evolved during combustion of electric cables -
IEC: 60332 (Part I to 3)	Tests on electric and optical fibre cables under fire conditions
IS 3961 (Part II)	Recommended current rating for cables - PVC insulated and PVC sheathed heavy-duty cables.
IS 10418	Drums for electric cables.
SS 4241475	Swedish chimney test

2.2 CONSTRUCTIONAL FEATURES

i) Cables shall be suitable for laying in racks, ducts, trenches, conduits and underground-buried installation with uncontrolled back fill and chances of flooding by water. They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating conditions.

ii) The Aluminium/Copper wires used for manufacturing the cables shall be true circular in shape before stranding and shall be uniformly good quality, free from defects.

iii) A distinct extruded inner sheath shall be provided in all armoured cable. The fillers and inner sheath shall be of non-hygroscopic, fire retardant material, softer than insulation & suitable for the operating temperature of the cable & compatible with the insulating material. The outer sheath shall be suitable for the operating temp. of the cable. ~~For single core cable, inner sheath may not be provided~~.

iv) Progressive sequential marking of the length of cable in meters at every one-meter shall be provided on the outer sheath of all cables.

v) All power & control cables shall have an extruded outer sheath of PVC having following flame retardant & low smoke evolution properties.
Oxygen index - Minimum 29 (to ASTMD 2863).
Acid gas emission - Maximum 20% by weight (to IEC 754 – I).
Smoke density rating – Maximum 60% (to ASTMD 2843).

vi) All cables shall be suitable for high ambient high humid tropical Indian climatic conditions.

vii) The normal current rating of all PVC insulated cables shall be as per IS 3961.

viii) All cables shall conform to type test and shall be subjected to routine and acceptance tests listed in the specification.

ix) Allowable tolerance on the overall diameter of the cables shall be ± 2mm.

x) The minimum bending radius for the cables shall be equal to 12*D, where D is the overall diameter of the cable for multicore cables and 15*D for single core cable.

xi) Suitable chemicals shall be added to the outer sheath of all cables to protect from rodent, vermin and termite attack.

xii) Repaired cables shall not be acceptable.

xiii) Cores shall be identified as per IS 1554 (Part-I)/ IS 7098 Part-I for the cables upto five (5) cores and for cables with more than five (5) cores the identification of cores shall be done by printing legible Hindu Arabic numerals on all cores as per Clause 10.3 of IS 1554 (Part-1).

xiv) Manufacturer's name, type of cable, number of cores, year of manufacture and sequential marking of length in metres at every one metre shall be permanently marked on the outer sheath throughout the entire length of cable.

2.3.1 Normal current rating shall not be less than that covered by IS 3961. Vendor shall submit data in respect of all cables in the prescribed format.

2.3.2 PVC insulated cables shall be suitable for continuous conductor temperature of 70 °C and short circuit withstand temperature of 160 °C. Tables giving de-rating factors for various conditions of cable installation including the following, for all types of cables shall be furnished -

- Variation in ambient air temperature.
- Variation in ground temperature.
- Depth of laying.
- Cables laid in the ground
- Cables laid in trench
- Cables laid in ducts
- Soil resistivity.
- Grouping of cables.

Overall derating factor for cable shall be 0.8 or less.

2.3.3 The value of short circuit withstand current ratings of all cables shall be indicated for a short circuit for 1 second duration and should also specify the maximum temperature during short circuit.

2.3.4 The following factors shall also be accounted for, while specifying the maximum short circuit withstand of the cables.

2.3.4.1 Deformation of the insulation, due to thermo-mechanical forces produced by the short circuit conditions, can reduce the effective thickness of insulation.

2.3.4.2 Conductor and core screens can be adversely affected with loss of screening effect. Likewise the thermal properties of the outer sheath material can be the limitation.

2.3.4.3 It is essential that the accessories, which are used in the cable system with mechanical and/or soldered connections, are suitable for the temperature adopted for the cables.

2.3.5 Formula for calculating short circuit current for different duration or curve showing short time current v/s time for different sizes of cables shall be furnished by vendor.

2.4 CABLE DRUMS

2.4.1 Cables shall be supplied in non-returnable wooden cable drum or steel drum of heavy construction. It shall be made of good quality wood, pressure impregnated against fungal and insect attack. Wood preservative shall be applied to the entire drum. The ends of the each length of cable shall be sealed before dispatch.

2.4.2 All Control and Power Cables shall be supplied in drum length of 1000 m, unless otherwise specified. For power cable with conductor cross sectional area 300sqmm and above may be supplied in 500m drums. Each drum shall contain one continuous length of cable. Owner shall

have the option of rejecting cable drums with shorter lengths. The cable length per drum is allowed a tolerance of ±5%. The tolerance allowed on total quantity of each size is ±2%. Where the ordered quantity is not multiple of 1000/500 m and the incremental quantity is very small, the same may be included in one of the drums. Otherwise, an additional length for the incremental quantity will be supplied.

2.4.3 A layer of water proof paper shall be applied to the surface of the drums and over the outer most cable layer.

2.4.4 A clear space of at least 40mm shall be left between the cables and the logging.

2.4.5 Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of the cable, net and gross weight stenciled on both sides of drum. A tag containing the same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wordings shall be marked on one end of the reel indicating the direction in which it should be rolled.

2.4.6 Packing shall be sturdy and adequate to protect the cables, from any injury due to mishandling or other conditions encountered during transportation, handling and storage. Both cable ends shall be sealed with PVC/Rubber caps so as to eliminate ingress of water during transportation and erection.

2.5 TESTS

All types and sizes of cables shall be subjected to following routine and acceptance tests and type tests.

2.5.1 Type and Acceptance test

~~The following test shall be performed on one length from each manufacturing series of same type and size of cable, covering at least 10% of all cable drums / test reports shall be submitted as per Section-5. The type and acceptance tests shall be witnessed by purchaser / purchaser's representatives.~~

~~a) Annealing test (for Copper conductor), Tensile & Wrapping Tests (for Aluminium for conductor) as per IS 8130.~~

~~b) Conductor resistance test as per IS 8130.~~

~~c) Test for armouring wires/ formed wire (% Elongation, Tensile, Torsion/ winding, Resistance, Wt of Zinc coating, Dimension and uniformity of coating) as per IS 1554 (Part I), IS 7098 (Part I), IS 3975.~~

~~d) Check for dimensions of insulation, sheath and conductor as per IS 1554 (Part I), IS 7098 (Part I).~~

~~e) Physical tests for insulation and sheath as per IS 1554 (Part I), IS 7098 (Part I), IS 5831 as applicable.~~

~~f) Insulation resistance test as per IS 1554 (Part I), IS 7098 (Part I), IS 5831 as applicable.~~

~~g) High voltage test at room temperature as per IS 1554 (Part I), IS 7098 (Part I) as applicable.~~

~~h) High voltage test (water immersion test) as per clause 16.3 of IS 1554 (Part I).~~

~~i) Flammability test as per clause 2.5 IEEE-383 / IEC 60332 part 3.~~

~~j) Smoke density rating test as per ASTM-D2843.~~

~~k) Oxygen index and Temperature index test as per ASTM-D2863.~~

~~l) Acid gas generation test as per IEC: 60754~~

~~m) Flammability test as per IS 1554 Part-I/ IS 7098 Part-1.~~

~~n) Swedish chimney test F3 category as per SS 4241475~~

~~Following special type tests shall be performed on one sample from each lot of the offered cables:~~

~~a) Hydraulic Stability Test~~

~~b) Ultraviolet Test as per DIN 53387~~

The prices for conducting all tests as per Cl. No. 2.3, 2.4 and 12.0 of Annexure-1, Section-1 are deemed to be included in respective cable prices.

2.5.2 Routine tests

The following routine tests shall be conducted on full length of the cable. These shall be witnessed by purchaser / purchaser's representatives.

a) High voltage test as per clause 16.2 of IS 1554 (Part I).

b) Conductor resistance test as per clause 6.3 of IS 8130.

B. EQUIPMENT SPECIFICATION FOR FIRE SURVIVAL CABLE

1.0	Type of cable	Fire survival cable
2.0	Standard applicable in general	IS: 9968(part-1), IS: 6380
3.0	Voltage Grade	1.1 kV
4.0	**CONDUCTOR**	
(a)	Material	Copper
	Grade and Class	Stranded, Tinned annealed high conductivity, Class 2
(b)	Standard applicable	IS : 8130
©	Fire proof layer	glass mica tape
5.0	FIRE BARRIER TAPE	Glass Mica tape in two layers with minimum 50% overlap, suitable to meet performance requirements as per Clause 11 (g) below
6.0	**INSULATION**	
(a)	Material	Elastomer rubber type IE2
(b)	Standard applicable	IS : 9968(Part-1)/1988
(c)	Continuous withstand temperature	90° C
(d)	Short circuit withstand temperature	250° C
7.0	**CORE IDENTIFICATION**	Colour coding as per IS 9968-PART1
8.0	**INNER SHEATH**	
(a)	Material	HOFR FRLS elastomeric type SE-3 (extruded)
(b)	Standard applicable	IS : 9968(Part-1)/1988

9.0	**ARMOUR**	
(a)	Material	Single layer Round Galvanised Steel wire for multi core cable. For single core cable aluminium round wire armour.
(b)	Gap between armour wires/ formed wires	Shall not exceed one armour wire/ formed wire space (No cross-over/ over-riding).
(c)	Breaking load of joint	95 % of normal armour
10.0	**OUTER SHEATH**	
(a)	Material	HOFR FRLS elastomeric type SE-3 (extruded)
(b)	Standard applicable	IS : 9968(Part-1)/1988
(c)	**Colour**	Black
11.0	**HOFR CHARACTERISTICS**	
(a)	Oxygen index	≥30 (as per ASTMD 2863)
(b)	Temperature Index	≥350. C (as per ASTMD-2863)
(c)	Acid gas generation	≤ 0.5% by weight (as per IEC-60754-1)
(d)	Smoke density rating	≤ 20% (As per ASTMD 2843)
(e)	Water absorption test	As per IS : 6380-1984

(f)	UV Radiation Test	As per BS EN ISO 4892-2/ ASTM G154 Clause 16.3 of IS 1554 (Part-I)
(g)	Flammability test	
	1.	Cable shall pass test under fire condition as per IS-10810-Part-53
	2.	Cable shall also pass test under fire condition as per IS-10810-Part-61/IEC-332-PARTI, IS-10810-part-62 & IEEE-383. Category group shall be considered as Category 'A'
	3.	In addition to test 1 & 2 above shall pass test as per –IEC-331 (750°C for 3 Hrs.)
12.0	Rodent & Termite Test	To be conducted
13.0	**CABLE DRUMS**	
(a)	Type & construction	As per IS 10418
(b)	Standard drum length	500m (+/-) 5%

TYPE TEST REQUIREMENTS FOR FIRE SURVIVAL CABLES

S. No.	TEST	APPLICABLE FOR	REF. STD	CLASSIFICATION OF TEST
1.0	**Tests for Conductor**			
a)	Persulphate test	For copper conductor	IS : 8130-PART1, IS : 10810, PART-4	T
b)	Annealing test	For copper conductor	IS : 8130-PART1, IS : 10810, PART-1	T,A
c)	Resistance test	For copper conductor	IS : 8130-PART1, IS : 10810, PART-5	T, A,R
2.0	**Tests for Armour**			
a)	Measurement of dimensions	Applicable for Aluminium wire & GS wire	IS : 3975	T,A
b)	Tensile test	Applicable for Aluminium wire & GS wire	IS : 3975	T,A
c)	Elongation test	Applicable for GS wire only	IS : 3975	T,A
d)	Torsion test	For GS round wire only	IS : 3975	T,A
e)	Resistance test	Applicable for Aluminium wire & GS wire	IS : 3975	T,A,R
f)	Zinc coating test	For G. S. wires only	IS : 3975	T,A
g)	Wrapping Test	For Aluminium wires only	IS : 3975	T,A
3.0	**Test for Fire Barrier Tape**			
a)	Test for minimum thickness	Fire barrier tape	IS :9968 PART1, IS : 10810, PART-6	T,A
4.0	**Tests for Insulation & inner and outer sheath (EPR)**			
a)	Material	Applicable for insulation and Inner & outer sheath	IS :9968 PART1	T,A
b)	Test for thickness	Applicable for insulation and Inner & outer sheath	IS :9968 PART1, IS : 10810, PART-6	T,A
c)	Tensile strength and elongation test	Applicable for insulation and Inner & outer sheath	IS :6380-1984, IS : 10810, PART-7	T,A
d)	Ageing in air oven	Applicable for insulation	IS :6380-1984, IS : 10810, PART-11	T
e)	Ageing in air bomb	Applicable for insulation and Inner & outer sheath	IS :6380-1984, IS : 10810, PART-56	T
f)	Hot set test	Applicable for insulation and Inner & outer sheath	IS :6380-1984, IS : 10810, PART-30	T,A
g)	Oil resistance	Applicable for insulation and Inner & outer sheath	IS :6380-1984, IS : 10810, PART-31	T
h)	Tear resistance	Applicable for insulation and Inner & outer sheath	IS :6380-1984, IS : 10810, PART-17	T

S. No.	TEST	APPLICABILITY FOR	REF. STD	CLASSIFICATION OF TEST
5.0	**Electrical tests**			
a)	Insulation resistance	Applicable for insulation	IS :6380-1984, IS : 10810, PART-43	T,A
b)	High voltage test	Applicable for Inner & outer sheath	IS :9968-PART1, IS : 10810, PART-45	T,A,R
c)	Water absorption test	Applicable for insulation	IS :6380-1984, IS : 10810, PART-28	T
6.0	**HOFR Tests (On complete cable)**			
a)	Oxygen Index test	For HOFR elastomer (extruded) inner & outer sheath	ASTMD-2863	T, A
b)	Temperature index test	For HOFR elastomer (extruded) inner & outer sheath	ASTMD-2863	T, A
c)	Smoke density test	For HOFR elastomer (extruded) inner & outer sheath	ASTMD 2843	T, A
d)	Swedish chimney test	For complete cable	Class F3 of SEN-S5-424-1475	T, A
7.0	Flammability Tests	For complete cable	IS-10810-Part-53, IS-10810-Part-61/IEC-332-PARTI, IS-10810-part-62 & IEEE-383	T
8.0	Fire Survival Tests	For complete cable	IEC-60331	T

T: SHALL BE CONDUCTED AS TYPE TEST
R: ROUTINE TEST
A: ACCEPTANCE TEST

SAMPLING PLAN :

A. TYPE TESTS : Type tests shall be conducted on one size/lot of finished cable except the Fire Survival Test 8.0 for which the sampling plan shall be 'all sizes/ lot'. The Type tests may be witnessed by BHEL/ Owner, for which due notice shall be given by the vendor.
B. Routine tests shall be conducted on 100% drums.
C. Acceptance tests shall be conducted on 3 drums/ lot.

SECTION-3

3.0 GENERAL

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

3.1 PROJECT INFORMATION AND SYSTEM PARAMETERS

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

i)	Basic Wind speed	47 m/sec
j)	Annual mean wind speed	4km/hr
k)	Terrain category	2
l)	Annual average rain fall	312 mm

SYSTEM PARAMETERS

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

AUXILIARY POWER SUPPLY

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

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

3.2 GENERAL TECHNICAL REQUIREMENT

3.2.1 TYPE TESTS

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

Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off.

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

3.2.3 CODES AND STANDARDS

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

3.3 MATERIAL/WORKMANSHIP

3.3.1 General Requirement

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

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

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

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

3.3.2 Provisions For Exposure to Hot and Humid climate

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

3.4 COLOUR SCHEME AND CODES FOR PIPE SERVICE/PANELS

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

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All the steel works shall be thoroughly cleaned of rust, scale, oil, grease, dirt and scarf by pickling, emulsion cleaning, etc. The sheet steel shall be phosphated /oven dried and then painted with two coats of zinc rich primer paints. After application of the primer, two coats of finished synthetic enamel paint shall be applied. The colour of the finished coats inside shall be **glossy white** and exterior of the treated sheet steel shall be **shade 631 of IS 5 /RAL 7032** for all switchboard /MCC/distribution board, control panels etc.

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

3.5 PROTECTION

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

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

3.6 FUNGI-STATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

3.7 SURFACE FINISH

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

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

3.8 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels, structures, shall be hot dip galvanized conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be **610 gm/sq.m** and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM. Average weight of zinc coating shall be **750gm/sq.m.**

3.9 PACKING

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

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

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

3.10 HANDLING, STORING AND INSTALLATION

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

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

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning.

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

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

3.11 DEGREE OF PROTECTION

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

a) Installed out door: IP-55

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

c) Installed in covered area IP:52

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

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

3.12 RATING PLATES, NAME PLATES AND LABELS

Type or serial number together with details of the loading conditions under which the item of the substation in question has designed to operate and such diagram plates as may be required by the Purchaser. The rating plate of each equipment shall be according to IEC requirements.

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

3.13 EARTHING

Circuit breakers, LA, Isolator, CVT , CT , BPI shall be provided with two grounding pads suitable for connection to galvanized steel flat. Control panels, Relay panel, outdoor marshalling boxes, Junction boxes, Lighting panels and distribution board shall be provided with two grounding pads,

for connection to galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment. Earthing of hinged door shall be done by using a separate earth wire.

3.14 TERMINAL BLOCKS AND WIRING

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

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

Terminal block for current transformer and voltage transformer secondary leads shall be provided with **test links and isolating facilities.** The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

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

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

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

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

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

There shall be a minimum clearance of 250mm between the first bottom row of terminal block and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm. The Supplier shall furnish all wire, conduits and terminals for the necessary inter-phase electrical connection (where applicable) as well as between phases and common terminal boxes or control cabinets.

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

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

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

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

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

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

All boxes/cabinets shall be designed for the entry of cables from bottom by means of weather proof and dust-proof connections. Boxes and cabinets shall be designed with generous clearances to avoid interference between the wiring entering from below and any terminal blocks or accessories mounted within the box or cabinet. Suitable cable gland plate projecting atleast 150 mm above from the base of the Marshalling Kiosk/box shall be provided for this purpose along

with the proper blanking plates. Necessary number of cable glands shall be supplied and fitted on this gland. The gland shall project atleast 25mm above gland plate to prevent entry of moisture in cable crutch. Gland plate shall have provision for some future glands to be provided later, if required.

3.16 SPACE HEATERS

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

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

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

3.17 QUALITY

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

3.18 DOCUMENTATION

3.18.1 LIST OF DOCUMENTS

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

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

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

3.18.2 DRAWINGS

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

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

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

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

3.18.3 APPROVAL PROCEDURE

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

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

Note: The contractor may please note that all resubmissions must incorporate, all comments given in the submission by the Employer failing which the submission of documents is likely to be returned. Every revision shall be a revision number, date and subject, in a revision block provided in the drawing, clearly marking the changes incorporated.

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

3.18.4 DOCUMENTS TO BE SUBMITTED ALONGWITH OFFER

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

3.18.5 DOCUMENTATION SCHEDULE

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

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

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

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

SECTION-4

CHECK LIST FOR INFORMATION TO BE FURNISHED WITH OFFER RETURN THIS CHECKLIST AS PART OF THE OFFER DULY SIGNED

The offer may not be considered if the following information and this Checklist are not enclosed with the Offer.

BHEL ENQUIRY. NO:

BIDDER OFFER REFERENCE:

A)

(1)	(2)	(3)	(4)	(5)
S.No.	**Parameters**	**Data**	**Yes / No**	**Remarks in case reply in Col (4) is *NO***
1.0	**Applicable Standard**	**Latest IS -1554, 5831, 8130, 7098, 3975, 613, ASTM-D2843, ASTM-D2863, IEC60754, IEC60332, IS3961, IS 10418, SS4241475, NEMA WC-70, IEEE-383**		
2.0	**Type**	**FRLS**		
3.0	**Construction feature for PVC Control ~~and Aux Power~~ cable**			
3.1	Material of Conductor for Control cables	Plain Annealed, High Conductivity, Stranded, untinned Copper (with minimum 7 strands), Grade EC		
3.2	~~Material of Conductor for Power cables~~	~~Stranded Aluminium, Grade H2 /H4~~		
3.3	Conductor Insulation for Control ~~and Power~~ cables	Extruded PVC, Type-A		
3.4	Inner sheath	Extruded PVC, Type ST-1		
3.5	Armouring for Control Cables	Galvanised Steel Round wire ~~/formed wire~~ for multicore cables		
3.6	~~Armouring for Aux Power Cables~~	~~Aluminium round wire for Single core~~ ~~And~~ ~~Galvanised Steel round wire/formed wire for Multi-core cables~~		
3.7	Outer sheath for Control and Power cables	PVC extruded, FRLS, Type ST-1, Category C2		

(1)	(2)	(3)	(4)	(5)
S.No.	**Parameters**	**Data**	**Yes / No**	**Remarks in case reply in Col (4) is *NO***
4.0	**Construction feature for XLPE Aux Power cable**			
4.1	Material of Conductor for Power cables	Stranded Aluminium (with minimum 7 strands), Grade H2 /H4		
4.2	Conductor Insulation	XLPE		
4.3	Inner sheath	Extruded PVC, Type-ST2		
4.4	Armouring for Aux Power Cables	Aluminium round wire/strip for Single core And Galvanised Steel round wire/formed wire for Multi-core cables		
4.5	Outer sheath	PVC extruded, FRLS, Type ST-2, Category C2		
5.0	**FRLS properties of Outer sheath**			
5.1	Minimum Oxygen index	29		
5.2	Minimum Temperature index	250°C		
5.3	Acid gas emission	Max 20% by weight		
5.4	Smoke density rating	Max 60%		
6.0	**Tolerance on overall diameter**	**± 2mm**		
7.0	**Chemicals added to outer sheath to protect from rodent, vermin and termite attack**	**Yes**		
8.0	**Drum lengths shall be 1000m for cables with conductor cross section area less than 300 sq mm**	**Yes**		
9.0	**Tolerance on total quantity**	**± 2%**		
10.0	**Minimum bending radius for multicore cables**	**12 x D**		

(1)	(2)	(3)	(4)	(5)
S.No.	**Parameters**	**Data**	**Yes / No**	**Remarks in case reply in Col (4) is *NO***
11.0	**Core Identification**	By colour coding as per IS 1554 (Part-I)/ IS 7098 Part-I for the cables upto five (5) cores; and for the cables with more than five (5) cores, by printing legible Hindu Arabic numerals on all cores as per Clause 10.3 of IS 1554 (Part-1).		
12.0	The fillers and inner sheaths shall be of non-hygroscopic, fire retardant material, shall be softer than insulation and outer sheath shall be suitable for the operating temperature of the cable	**Yes**		
13.0	Instrumentation Cables	**Fully conforming to technical specification mentioned in Annexure-1, Section-1**		
14.0	Fire Survival Cables	**Fully conforming to technical specification mentioned in Annexure-1, Section-1**		

B) TYPE TESTS

i) Whether valid type test reports of all the type tests including additional tests mentioned in this specification, conducted earlier on identical material are available (test reports shall be of the tests conducted not earlier than 5 (five) years prior to the date of bid opening). **(YES/NO)**

ii) If valid type test reports are not available with bidder / test reports are not acceptable to BHEL/Customer, then above tests shall be conducted by the bidder free of cost.

(YES)

iii) Whether the prices for conducting all tests as per Cl. No. 2.3, 2.4 and 12.0 of Annexure-1, Section-1 are included in respective cable prices.

(YES)

C)

(1)	(2)	(3)
S.No.	**Description**	**Confirmation of Supplier**
1.	Bidder to confirm that at all drawings / data sheets/QP/ valid type tests reports/ all relevant information shall be submitted to BHEL for organising approval of ultimate customer.	

Date:

Signature of the authorized representative of Bidder

Company Seal